COORDINATION OF ACTIVITIES OF FEDERAL AGENCIES IN BIOMEDICAL RESEARCH

THE UNIVERSITY OF MICHIGAN
JAN 10 1961
MAIN READING ROOM

HEARING

BEFORE THE

SUBCOMMITTEE ON REORGANIZATION AND INTERNATIONAL ORGANIZATIONS

OF THE

COMMITTEE ON GOVERNMENT OPERATIONS

UNITED STATES SENATE

EIGHTY-SIXTH CONGRESS

SECOND SESSION

AGENCY COORDINATION STUDY

(PURSUANT TO S. RES. 255, 86TH CONG.)

AUGUST 11, 1960

INCLUDING EXHIBITS IN THE FORM OF LETTERS, MEMORANDUMS, AND ARTICLES

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COORDINATION OF ACTIVITIES OF FEDERAL AGENCIES IN BIOMEDICAL RESEARCH

(Pursuant to S. Res. 255, Sec. 4, 86th Cong.)

THURSDAY, AUGUST 11, 1960

U. S. SENATE,
SUBCOMMITTEE ON REORGANIZATION AND INTERNATIONAL ORGANIZATIONS OF THE COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10:10 a.m., in room 3302, New Senate Office Building, Senator Hubert H. Humphrey (chairman of the subcommittee) presiding.

Present: Senators Humphrey, Muskie, and Mundt.

Also present: Gregory Abdian, Program Division, Research Data and Information Services, National Science Foundation; Burton W. Adkinson, Head, Office of Science Information Service, National Science Foundation; Ernest M. Allen, Chief, Division of Research Grants, National Institutes of Health; Keith Cannan, Chairman of Division of Medical Sciences, National Academy of Sciences-National Research Council; Walter D. Claus, Special Assistant to Director, Division of Biology and Medicine, Atomic Energy Commission; Edward H. Cushing, Office of Assistant Secretary of Defense (Health and Medical), Department of Defense; Stella Leche Deignan, Director, Bio-Sciences Information Exchange; Charles Dunham, Director, Division of Biology and Medicine, Atomic Energy Commission; James Hundley, Assistant to the Director, National Institutes of Health; George W. Irving, Jr., Deputy Administrator, Agricultural Research Service, U.S. Department of Agriculture; Joseph Murtaugh, Acting Chief, Office of Program Planning, National Institutes of Health; M. J. Musser, Department of Medicine and Surgery, Veterans' Administration; Clark T. Randt, Director, Office of Life Sciences Programs, National Aeronautics and Space Administration; Evelyn M. Roll, Administrative Assistant, Bio-Sciences Information Exchange; Charles B. Ruttenberg, Deputy General Counsel, National Science Foundation; James A. Shannon, Director, National Institutes of Health; Col. John M. Talbot, Chief of Biological and Medical Sciences Division, Office of Science, Office of Director of Defense, Research and Engineering; James Watt, Director, National Heart Institute, National Institutes of Health; John T. Wilson, Director, Division of Biological and Medical Sciences, National Science Foundation; Walter L. Reynolds, Chief Clerk, Committee on Government Operations; and Julius N. Cahn, Director of Scientific Research Project, Subcommittee on Reorganization and International Organizations, Committee on Government Operations.

Senator HUMPHREY (presiding). The subcommittee will come to order.

We meet today pursuant to Senate Resolution 255, sections 1–4, of the 86th Congress.

I believe it would be well to have the full text of the particular sections of the resolution published at this point in the record.

The excerpts of the resolution referred to are as follows:

EXHIBIT 1

TEXT OF SENATE RESOLUTION 255, 86TH CONGRESS, SECTIONS 1–4, AUTHORIZING AGENCY COORDINATION STUDY

[S. Res. 255, 86th Cong., 2d sess.]

RESOLUTION

Whereas, pursuant to S. Res. 347, Eighty-fifth Congress and S. Res. 42, Eighty-sixth Congress, the Committee on Government Operations has been conducting a "complete study of any and all matters pertaining to the international activities of Federal executive branch departments and agencies relative to worldwide health matters"; and

Whereas the study indicates significant problems of coordination between (a) numerous agencies of the United States Government engaged in health activities, (b) agencies of the United States Government and international organizations of which the United States is a member, (c) official programs of the United States Government and related nonofficial programs of private voluntary organizations, in addition to problems of Federal budgeting and accounting; and

Whereas the study confirms the continued existence of certain problems of the interagency organization of common Federal activities such as documentation and other problem areas of management of the general type revealed in past studies by the Commission on the Organization of the Executive Branch of Government; and

Whereas pursuant to rule XXV of the Standing Rules of the Senate, the Committee on Government Operations has the duty of studying the operation of Government activities at all levels with a view to determining its economy and efficiency, and the further duty of studying intergovernmental relationships between the United States and international organizations of which the United States is a member: Now, therefore, be it

Resolved, That the Committee on Government Operations, or any duly authorized subcommittee thereof, is authorized under sections 134(a) and 136 of the Legislative Reorganization Act of 1946, as amended, and in accordance with its jurisdiction specified by rule XXV of the Standing Rules of the Senate—

(a) to complete its study of worldwide health research, assistance, and rehabilitation matters; and

(b) to examine, investigate, and make a complete study of any and all matters in scientific and other fields where there may be indications of a need for (a) improved budgeting, accounting, and other managerial practices on the part of agencies of the United States Government; (b) strengthened cooperation and coordination among Federal agencies; (c) effectiveness of international organizations of which the United States is a member; and (d) avoidance of Federal duplication of private responsibilities and activities.

SEC. 2. For the purposes of the first section of this resolution the committee, from February 1, 1960, through January 31, 1961, is authorized to (1) make such expenditures as it deems advisable; (2) employ upon a temporary basis, technical, clerical, and other assistants and consultants: *Provided*, That the minority is authorized at its discretion to select one person for appointment, and the person so selected shall be appointed and his compensation shall be so fixed that his gross rate shall not be less by more than $1,200 than the highest gross rate paid to any other employee; and (3) with the prior consent of the heads of the departments or agencies concerned, and the Committee on Rules and Administration, to utilize the reimbursable services, information, facilities, and personnel of any of the departments or agencies of the Government.

SEC. 3. The committee shall report its findings upon the study and investigation authorized by the first section of this resolution, together with its recommendations for legislation as it deems advisable to the Senate at the earliest practicable date, but not later than January 31, 1961.

SEC. 4. Expenses of the committee, under sections 1, 2, and 3 of this resolution, which shall not exceed $85,000, shall be paid from the contingent fund of the Senate upon vouchers approved by the chairman of the committee.

* * * * * * *

Senator HUMPHREY. This resolution authorized a study of interagency—I quote, "economy and efficiency."

We believe that it is axiomatic that any Federal program as vast, as diversified, as complex, as interrelated as biomedical research cannot possibly attain economy and efficiency unless there is a considerable degree of interagency coordination.

TEAMWORK OF AGENCIES SOUGHT

Now there are many ways that coordination may take place, and there are many types of results of coordination or a lack of it.

A few things we want to find out are: Are the agencies helping one another on common problems; are they drawing upon and using one another's knowhow and experience in order to get on with their jobs; or are they failing to work as a team, each instead going its separate way?

Obviously, they can't help one another unless one agency knows what the other is doing and has done and is capable of doing.

VASTNESS OF FEDERAL BIOMEDICAL RESEARCH

To show some of the dimensions of the interagency problem, I will introduce at this point in the record a brief staff memorandum containing a few preliminary notes. We will supplement it a little later on with charts and with still more detailed materials compiled by the staff at my direction.

I might point out that, by the very title and jurisdiction of this committee—the Committee on Government Operations—we are able, relatively uniquely, to look at the operations of the U.S. Government as a whole, rather than at, let us say, the Department of Health, Education, and Welfare alone. This governmentwide view is our theme throughout.

The staff memorandum follows:

EXHIBIT 2

STAFF MEMORANDUM OUTLINING TENTATIVE OBSERVATIONS ON THE MAGNITUDE, DIVERSITY, AND INTERRELATIONSHIP OF FEDERAL BIOMEDICAL RESEARCH PROJECTS

There follow a few pertinent statistics as to the magnitude, diversity, and distribution of Federal biomedical research:

1. Total obligational authority for 1961 fiscal year approved by the 86th Congress, 2d session for the National Institutes of Health, the principal Federal agency supporting biomedical research, $590 million.

2. Total estimated obligational authority for 1961 fiscal year, approved by the 86th Congress, 2d session, for biomedical research by all other Federal agencies, divisions, and bureaus (outside the National Institutes of Health), approximately $200 million.

(A report to be filed by the subcommittee by January 31, 1961, will contain a detailed breakdown of the figures in items (1) and (2). It should be noted that of NIH's current authority to spend $590 million, $110 million is designated

for research training, $30 million for research facilities construction, $22 million for fellowships, in addition to certain additional specific allocations for other than research projects, as such.)

TEN AGENCIES WITH BIOMEDICAL RESEARCH PROGRAMS

3. Number of principal Federal agencies engaged in or supporting biomedical research: 10. (See exhibit 69.)

(*a*) Agencies with programs $15 million or larger (for specific support of intramural or extramural research projects as such) in 1960 fiscal year: 6.

(Department of Health, Education, and Welfare, approximately $291 million, including NIH and other organizations; Atomic Energy Commission, $53.2 million; Department of Defense, $48.6 million; National Science Foundation, $24.4 million; Veterans' Administration, $17.3 million; Department of Agriculture, $16.1 million.)

(*b*) Agencies with smaller programs: 4 (National Aeronautics and Space Administration, $1.8 million; Federal Aviation Agency, $930,000; International Cooperation Administration, $927,000; Department of Interior, $697,000).

(See Note by Chairman Humphrey, preceding Exhibit 69, as regards the grand total, subtotals, and breakdown of these respective agency figures.)

4. Total number of Federal personnel—scientific, professional, and technical—engaged full time or part time in biomedical research: 5,900 (estimated).

5. Total active biomedical research projects (Federally and nonfederally supported) registered with Bio-Sciences Information Exchange: 30,000.

6. Total terminated projects registered with Bio-Sciences Information Exchange: 19,000.

7. Total projects, active or inactive, not registered with the Bio-Sciences Information Exchange: unknown.

8. Total number of biomedical investigators registered with the Bio-Sciences Information Exchange: 92,000 (of whom 40,000 are estimated to be principals).

9. Total number of research institutions whose U.S.-supported projects are registered with Bio-Sciences Information Exchange: 3699.

THE COMPLEXITY OF INTERRELATIONSHIPS

The above statistics are but a few quantitative measurements of the vast scope of Federally supported biomedical research. Qualitatively, however, neither these nor other statistics could attempt to indicate the vast amount of actual and potential interrelationships between research projects.

It has been the subcommittee's working hypothesis that the management of these projects on the part of Government administrators may inherently represent a task of increasing difficulty. And the management of information on the projects—before the projects commence (i.e., while applications are being considered), while the projects are in process, and most important, after they are completed and results are available—is a formidable task in itself.

There are several types of information. The Federal research administrator must constantly manage administrative-budget-accounting-type data. But he must manage scientific data as well, e.g., data about and in pending applications, particularly because an applicant may apply to not merely one but two or three agencies, simultaneously or in sequence.

Even if the applicant applies to but a single source, his proposal may involve on-going work already being supported by other Federal sources and/or of interest to them. Thus, a decision may be difficult to make as to which alternative agency or institute or bureau or division or center should undertake to support a proposed effort alone and/or in concert with another source, public or private.

Federal officials are well aware that in the expenditure of taxpayers' resources, special care must be taken toward informing and keeping informed, assisting and seeking assistance from other agencies, as appropriate.

Standard channels of scientific communication can hardly be regarded as sufficient for this process of fulfilling Federal responsibility.

LINES OF COMMUNICATION

Lines of communication must be available for smooth flow of information (*a*) within Federal departments and agencies, i.e., between institutes, between Washington and the field, between study sections, between grant councils; (*b*) between Federal departments and agencies; (*c*) between disciplines.

If information does flow smoothly, if it is available when it is needed, in the way it is needed, by whom it is needed, it may be presumed that the first step is taken toward capitalizing on the information to the fullest, that is, deriving as much possible value from it in as many possible places, in as many possible ways as can be achieved.

EMPHASIS ON INTERAGENCY APPROACH

It will be noted that it is the interagency, interinstitute, interstudy section, intergrant council phase which is the subcommittee's central focus. It is well known that many of the most impressive advances in modern science have been made in the "border areas" between subjects and disciplines.

A fundamental premise of the subcommittee is that rigid boundary lines do not exist in Nature, so, as a principle, it cannot be presumed that information on and from research can be safely or easily or fruitfully deposited in merely one "slot," one category, one study section, one grant council, without potential reference to or consideration or at least cognizance by others.

THE PROBLEM OF WHAT IS RELEVANT

Referral of data to not one but several sources and expert cross-referencing of stored information become vital therefor.

How this may work out in an information system may be seen in the case of the Bio-Sciences Information Exchange. Its indexing system contains 211 different indexes and groupings, with a total of 6,939 subcategories.

The problem of determining "what is relevant to what" is one of the most crucial in science. Observers have pointed out that if, for example, it had been promptly determined that the pioneering experiments on sweet peas as conducted and reported by Gregor Mendel were relevant to the biology of man, as much as three decades might possibly have been saved in opening up the impressive field of genetics.

Today, a subject matter such as virology is expanding in so many directions with so many implications that the management of information on it or on other dynamic topics becomes increasingly difficult.

THE DELICATE BALANCE

Time is, of course, limited for both the scientist and the administrator—time to read, to inform, to confer, to report. The subcommittee recognizes that the essential task is to get on with the research, to do the job, to give the working scientist the opportunity, the stimulus, the surroundings in which and with which to work at optimum level.

Seeking the balance, then, between administrative planning and scientific freedom, between reporting and doing, conferring and individual working, between decisionmaking in concert with others and alone, is clearly a goal beyond any arbitrary formula.

How well the balance is actually achieved in practice is a matter the subcommittee seeks to explore with understanding and care.

Senator HUMPHREY. Let me make certain additional points clear so that there will be no misunderstanding.

PERSONAL SUPPORT FOR EXPANDING RESEARCH

First of all, I am sure that every witness here knows of our deep, sincere, and friendly concern and interest in the field of research. I refer to every aspect of research, particularly the field of medical research, and to a feeling that I personally have, speaking only for myself, as regards the extension and expansion of those research activities.

We will be speaking throughout this hearing and we will be reading in the exhibits in statistical, particularly fiscal terms, in view of the nature of the jurisdiction of this committee. But let no one forget that what we are really talking about is the best way of coming up

with answers to save human lives, to reduce pain, to give hope to the afflicted, to provide brighter vistas for the unborn.

REVIEW FROM TOP POLICY TO GRASSROOTS LEVELS

Secondly, as to our focus today, we are, as indicated, going to look at problems of interagency cooperation and coordination.

We would like to explore these problems from the level of top policy—namely, policy established or not established at the White House level down to problems of communicating between working scientists in field laboratories of different agencies—say, the Rocky Mountain Laboratory in Montana and the Communicable Disease Center in Georgia.

Within this broad area of problems, we will single out for special attention the exchange of written information as regards current research. When I use the word "current," I mean "continuing research," including research begun in the last year, the last year and a half, 24 months or so, if not yet completed and published in a technical journal.

MEASURING QUANTITATIVE DATA

We emphasize "written" information because it is identifiable and measureable. We recognize full well that scientists rely heavily on oral communication, on informal exchange of ideas and experience. But the subcommittee cannot easily measure such exchange of information.

We cannot measure how much knowledge a research administrator of one agency is carrying around in his head about the current efforts under support by other agencies. With hundreds of research projects in any field, we suspect that it is quite difficult for any administrator or any scientist, however competent, to store in his head all that he might otherwise like. And if there is no formal system to inform him in the first place, no print-out of data on others' current research, he may not get much chance to store in his mind or in his files what he should. So the subcommittee must try to ascertain whether necessary records are at least available, and whether they are used, by whom, how, and when.

As to oral exchanges, we could, of course, count up the number of conferences or meetings or other discussion sessions, but sheer numbers there, like sheer numbers of records themselves, are not meaningful. What counts is action, results.

If an information system is working, it can be a real asset. If a system is not working, if reliance is placed exclusively on random, spasmodic, ad hoc talks or visits, then there is a danger that a great deal of potentially useful information will be, for all intents and purposes, lost.

We are concentrating on this particular phase because, in part, current biomedical research is right now receiving about one-half billion dollars in Federal funds. We are interested in making sure that agency day-to-day decisions on this considerable volume of research are based upon adequate information as to who is already doing what, where, why, and how.

RESEARCH CREATIVITY IS NO AGENCY'S MONOPOLY

Of course, it isn't just the amount of money that is the subject of greatest concern. It is how it is being spent.

To my mind, economy in Government is not that you spend less. It is that you spend what you have well, maximize the effort and obtain as much as you possibly can out of the expenditures or the investments that you are making.

What we seek is creative research. We seek the same thing the agencies seek—as much successful research as possible. But success in research is not based on a "one-agency" monopoly. It can best be based on cooperation between institutes, bureaus, divisions, public and private sources, and between disciplines. The flow of information between them is therefore crucial.

ONLY LIMITED REVIEW IS POSSIBLE

I emphasize—we are not today attempting to look at all the problems of interagency coordination. I have necessarily restricted this field. Review of all phases of coordination would represent a much vaster problem, and it could not possibly be studied without a far larger staff on the part of this subcommittee than is currently available.

FINDINGS BY HOOVER COMMISSIONS

Another Hoover Commission would, in effect, be necessary for such a review.

I might add that the second Hoover Commission, the one in 1955, made some rather pertinent and important recommendations in the field of coordinating medical and scientific research on the part of Federal Government agencies. Most of those recommendations have never been acted upon. A summary of the Hoover recommendations will appear in appendix A.

WORKLOAD CONFRONTING SUBCOMMITTEE

To follow up on this interagency coordination problem, we have only had the full-time services here of one professional staff employee for this and all of our many other projects. We have right now a half dozen subcommittee medical publications in process. We have already published nine others. We will have three volumes of other hearings and of appendixes on international medical cooperation. That indicates something of our workload. We have, of course, called upon the agencies to cooperate and that has been done in the main, and we have used for short periods a few of their technical people. But the workload is our problem and our responsibility, and we are glad to fulfill it.

FOUR TYPES OF SUPPLEMENTAL MATERIAL

In order that this record may be as complete as possible, I am going to ask that the transcript, when published, be supplemented with

four types of items at various appropriate points: (1) past correspondence to and from this subcommittee with the Federal agencies in addition to several letters, pertinent to this hearing, which we will send out and on which we expect to receive replies during the next few weeks; (2) memorandums on my part, elaborating the background—i.e., the reasons for my efforts as chairman to compile particular information; (3) certain staff memorandums and charts which may also help assure adequate perspective from this transcript; (4) other pertinent articles.

Each item will appear at whichever location is most appropriate. It will be printed either (*a*) in the body of the record before or after pertinent testimony, or (*b*) in the appendix if it proves too long and might adversely affect continuity in reading the transcript.

In order to provide background and perspective on each of these various exhibits and appendixes, I am going to include in the record additional brief introductory statements. In so doing, I will indicate why we have compiled particular information, when, how, and in what way it fits in with the general subject which we are reviewing today.

MONTHS OF PRIOR REVIEW

I want this record to be as "rich" as possible with useful documentation. This is not a "one-shot" hearing. It has been preceded by months of effort. It will be followed by months of study on our part. While we may not be able to hold more hearings on this subject in 1960, this hearing record will, we hope, be almost as complete as a much longer set of hearings, had time been available for added oral presentations. We will, as indicated, hold the record open for sometime, so as to round out the exhibits which we have requested be furnished by the agencies.

We are up against a deadline of January 31, 1961, and we are trying to do our best to make the greatest possible contribution. If, therefore, we try to save time and get at the heart of problems through written as well as oral materials, our listeners and readers will understand.

RESPECT FOR EXPERT WITNESSES

This subject today is too important, too complex for but a few hours of comment. That is why we are supplementing the transcript with literally dozens of exhibits, all to be carefully identified and dated as to origin.

We are, by and large, merely laymen. We respect you experts who have dedicated your lives to science and, in many instances, to Government service as such. We don't believe that we can do justice to your specialties with but a few oral questions and answers. And so we are reproducing herein your detailed responses to our previous and future pertinent inquiries.

MEMORANDUM FORWARDED TO AGENCIES

In inviting the agencies to designate representatives to join with us today, I addressed a memorandum to each indicating the focus of our interest and the format of the hearing. In order, therefore,

that the testimony which will appear hereinafter can be best understood, I shall ask that there be included at this point the text of this notification memorandum.

The memorandum follows:

EXHIBIT 3

SUBCOMMITTEE MEMORANDUM NOTIFYING THE AGENCIES OF AUGUST 11, 1960, ROUNDTABLE CONFERENCE

JULY 28, 1960.

Memorandum from: Senator Hubert H. Humphrey, Chairman, International Health Study.
Re: Hearing, August 11, 1960.

Purpose of hearing

To explore "Problems of Interagency Coordination of Biomedical Research."

Place and time

Ten a.m., room 3300, New Senate Office Building.

Authority under which hearing is held

(*a*) Rule XXV of the Senate authorizes the Committee on Government Operations to review problems of Federal "budgeting and accounting," "economy and efficiency."

(*b*) Senate Resolution 255, sections 1 to 4, 86th Congress, authorizes review of problems of "interagency coordination." It also authorizes completion by January 31, 1961, of the medical study, originally authorized under Senate Resolution 347, 85th Congress.

Symposium-type review

The hearing is intended to be in the form of a symposium.

The subcommittee believes that the very nature of the subject matter—interagency coordination—requires a "roundtable" type discussion, rather than the reading of individual statements.

Executive session

Since the meeting is of an exploratory nature, it is not expected to be open to the public, unless the subcommittee decides otherwise.

The transcript will, in accordance with standard practice, be circulated among the participants and subsequently printed.

Subsequent review

Since the Senate's session, commencing August 8, will last but a few weeks and will involve many all-day meetings, it is not possible at the present time to schedule further hearings.

The topic of interagency coordination is so difficult and complex that this initial meeting can only touch upon a few highlights.

However, most of the participants have previously received from the subcommittee detailed inquiries bearing upon the problem. So, the topic is not a new one as regards our subcommittee's study.

Opening statement by Dr. James A. Shannon

For the purpose of opening the discussion, the subcommittee is asking Dr. James A. Shannon to lead off with the reading of a prepared statement.

Thereafter, we hope the discussion will be spontaneous, consisting of questions by the subcommittee and answers involving all participants.

No prepared statement need be readied or filed with the subcommittee by any other participant prior to or at the time of the meeting.

Statements for the record later on

However, following the meeting and its hoped-for clarification of issues, I expect to ask for a statement for the record by each of the participants. Such a statement would be filed with the subcommittee, with adequate time for preparation some weeks thereafter.

Participants who are invited

Agency or division	*Official (or his representative)*
National Institutes of Health	James A. Shannon, M.D.
Veterans' Administration	William Middleton, M.D.
National Science Foundation	John Wilson, Ph.D.
Atomic Energy Commission	Charles Dunham, M.D.
Department of Agriculture (Agricultural Research Service).	Kenneth Haines.
Department of Defense	Frank Berry, M.D.
National Aeronautics and Space Administration.	Clark T. Randt, M.D.
Bio-Sciences Information Exchange	Stella Leche Deignan, Ph.D.
National Academy of Sciences—National Research Council.	Keith Cannan, Ph.D.

As a possible guide to the type of subtopics we tentatively have in mind, please consult part 2.

You will find there a series of draft observations and related questions. These are presented solely for discussion purposes.

PART 2

Background observations on coordination problem

For purposes of brevity, there follow a few draft observations and questions on this vast and complex problem.

These notes are intended solely for discussion purposes and are not to be regarded as subcommittee conclusions.

Past appraisals by Hoover Commissions

In 1949 and 1955, the Hoover Commissions on Organization of the Executive Branch of the Government filed reports pointing up, among other phases, lack of coordination in biomedical research efforts by Federal agencies.

Since then, the magnitude of Federal and national research has greatly increased.

Multiple sources of support

Ten Federal agencies are now engaged in biomedical research. Over one-half billion dollars in new obligational authority for such research were asked of the Congress for the 1961 fiscal year.

As a matter of policy and law, multiple sources are available in the Federal Government for support of biomedical research. Thereby, the chances are improved for diverse, creative talent to be successful in securing support.

But the very existence among two, three, four, or more agencies of parallel or supplementary programs in any given field underlines the necessity for interagency communication and coordination.

Scientific discoveries, meanwhile, increasingly cross lines of demarcation between agencies and disciplines. The secrets of nature, of course, are not "organized" along the lines of Federal departments, agencies, study sections, or grant councils.

Agency response to coordination problem

Federal agencies have long recognized the problem of interagency coordination. Ex officio representatives of agencies sit on one another's study sections and grant councils.

A number of interagency programs exist, notably, the National Cancer Chemotherapy Service Center.

Professional contracts are maintained through visits, meetings, seminars, conferences, technical literature.

In the screening process on grants and contracts, there serve highly qualified scientific experts from outside the Federal Government, familiar with their colleagues and with specialized fields.

Information on current research differs from documentation problem

But the load of information which must be recalled as regards current research and researchers continuously increases.

This is separate from the sizable information load as regards past research, with its huge volume of published or orally disseminated results.

The subcommittee is focussing here on information exchange on research in process. Some of this research may never be published because of negative

results or other factors, or if published, may not become available for one, two, or more years.

At present, over 30,000 active projects are registered with the Bio-Sciences Information Exchange. Thousands more are not registered.

Already, the exchange contains information on over 90,000 investigators.

Applicant-type, contrasted to subject-type, information

The exchange is used extensively to determine prior and current awards to investigators applying for Federal support. However, in 1959, subject-type inquiries to the exchange numbered only 520 from all supporting agencies and 130 from nonsupporting Government agencies.

Do the agencies regard the last-mentioned fact as significant?

More basically, is there sufficient use of existing interagency mechanisms, procedures, publications, and clearinghouse for planning and collaborative purposes?

In effect, are the Federal agencies sufficiently informed of one another's ongoing research programs, e.g., through detailed, current analyses, so as to make their respective and mutual plans accordingly? And do the agencies inform the scientific community sufficiently as to their current programs, e.g., with project indexes, so that individual scientists can make the soundest possible decisions on applying for new support or in conducting current research?

How important is the absence of a readily available series of Federal publications summarizing (by more than title), and indexing current Federally supported research, intramural and extramural, in the life sciences?

SUMMARY—INTER-RELATING WITHOUT RIGIDITY

These are but a few of the questions in the area of information exchange, alone, on which expert judgment is sought. Thereby, steps may be taken toward increasing the yield of scientific results from current Federal programs.

Many other phases of the coordination problem exist and should be the subject of discussion.

It is well recognized that coordination should be achieved with flexibility, and not by some rigid formula. Scientific freedom requires individuality of approach. But that does not and should not mean that agencies can be indifferent to the interrelationships of research in process.

EXECUTIVE HEARING TO BE PUBLISHED LATER

Senator HUMPHREY. Now, with these background points covered, I would like to ask every single one of the principal spokesmen for each of the agencies here this morning to feel free to comment at any point during our proceedings.

This is an executive session, because we are dealing with material and information that I think would be best discussed, for the time being, in this rather private but official manner. We will, of course, publish the transcript a little later on, and will include within it a great many exhibits which we regard as quite useful.

Now, let's speak up.

Because so many of you are present, naturally each response will be comparatively brief. However, don't hesitate to present your individual views at any point in our proceedings without being specifically asked to do so.

In order that the verbatim reporter can be sure to identify you accurately, I would appreciate it if you would indicate your name and agency at least by its initials before you make any individual comments.

I want to make sure that at this point in the record the names of all witnesses who are present appear, and the agencies that they represent.

We have representatives here of 10 agencies of Government.

61916—60——2

APPRECIATION TO NATIONAL INSTITUTES OF HEALTH

Before commencing the formal statement of Dr. James A. Shannon, I should like to state that the subcommittee is indebted to the National Institutes of Health and to each of the agencies present today for their helpful assistance to this subcommittee during the past 2 years of our review.

Dr. Shannon, we welcome you back to our subcommittee. I want to, on behalf of the subcommittee, express our thanks for your helpful written responses to our various inquiries.

TYPES OF QUESTIONS WE ARE POSING

May I assure you that what we are after this morning is to see objectively what is being done or what is not being done in the field of exchange of information on current research. I reiterate—I am not talking about research done 4 years ago or 5 years ago or even 3 years ago, but things that are going on right now. We are asking, in effect, as the various staff memorandums have indicated:

Does every agency know what the other one is doing? Do the appropriate scientists know the projects that are being carried on related to their work? If so, how? If not, why?

Do the study sections and the grant councils have information at their disposal as to the trends and needs of research support not only in their own areas and disciplines but in related areas and disciplines inside and outside any given agency?

In other words, are applications handled only on an individual, ad hoc basis, or are they examined in part from the perspective of such facts as the amount of money already being expended for particular types of study under other auspices as well?

Are grant council decisions in any one agency based in part on current knowledge as to comparable and related grant decisions in other agencies, not only as regards the particular applicant and institution, but as regards the subject the applicant is seeking to explore?

TIMING OF HEARING

I might repeat that we have spent a lot of time preparing for this hearing. We could have held it sometime earlier, but for several reasons have not done so. We wanted to be fully prepared. We wanted to take as broad a view of the panorama of Federal research as any congressional committee had ever attempted to take. We wanted to see problems in fullest perspective.

Moreover, because of my own personal interest in the field of medical research, I have hesitated to hold this hearing before now. The next fiscal-year funds are right now being considered for the Department of Health, Education, and Welfare. I did not want any misunderstanding to develop as to what our purposes or premises were, particularly while the Appropriations Committees were meeting. I think those committees are doing excellent work; I have a very high regard for them;[1] we ourselves want to publish only a well-documented record which will be clearly understood and which will genuinely facili-

[1] See p. 50 for additonal comments on the important work of the Committees on Appropriations.

tate the advancement of biomedical research—a goal which I know they share.

Now, Dr. Shannon, we welcome your comments. We will have much helpful past correspondence with NIH to reprint in the record following your comments.

Please go ahead.

STATEMENT OF JAMES A. SHANNON, MD., DIRECTOR, NATIONAL INSTITUTES OF HEALTH

Dr. SHANNON. Thank you, sir.

Senator Humphrey, it is always very satisfying to me to cooperate with this subcommittee—and, if I may say so, with you, Senator Humphrey—because I am grateful for the valuable role which the subcommittee is playing in the development of medical research programs at both the national and international levels.

COMMENDATION OF COMMITTEE PRINTS

I am also much impressed by the excellent series of committee prints. These surveys have proved very useful not only to those responsible for program management at NIH but to everyone interested in the important topics covered.

I look forward to future issues which, I am sure, will be equally discriminating and informative.

I particularly welcome this opportunity to explore with you and with representatives of other interested agencies the points raised in your agenda for this hearing. The problems arising in connection with the administration of medical research and research grant programs loom much larger today than they did even a few years ago because of the extraordinarily rapid growth of medical and related biological research in this country.

MEDICAL PROPORTION OF TOTAL RESEARCH

During the past 5 years, our national expenditure on medical research has almost trebled, rising from about $240 million in 1955 to an estimated $715 million this year.

Such an expansion of effort is no less impressive for having been matched—or even surpassed—in other scientific fields. In the decade since 1950, our total national expenditure on research and development increased almost fivefold from $2.9 billion to $13.5 billion. Expenditure on medical research now represents no greater proportion of our total research and development costs than it did in 1950. For both 1950 and 1960, the figure is 5 percent.

However, as the increase in the total research and development expenditure includes rather sizable projects in nuclear and space sciences, it is both remarkable and heartening that the biological sciences have nevertheless kept pace.

PUBLIC INTEREST IN RESEARCH

The burden of financing the rapid expansion of medical research has been shared almost equally by the Federal Government and by non-Federal organizations. I am sure that Members of the Congress

derive a very proper satisfaction from the knowledge that their foresight in progressively increasing the appropriations made available for medical research seems to have stimulated a comparable flow of non-Federal funds.

Not germane to today's discussion, Senator Humphrey, but nonetheless germane to the long-range interests of this committee, is the conclusion to be drawn from this continued substantial increase in research activities funded by non-Federal sources, individuals, our great voluntary agencies, industry, and State governments. As in no other broad field of science, the citizens of this Nation are committed to the eradication of serious illness, to the extension of useful life, and to medically based problems of the major segments of our population, our children, and our aging citizens. They are committed to a solution of those problems through research and quite apart from a willingness to see Government accept serious responsibility for support. They, themselves, contribute generously and voluntarily from their personal and private earnings. Surely this phenomenon will be worthy of special notice when the social history of our Nation during midcentury is analyzed.

But while it is true that the Federal Government's share of the national expenditure on medical research has grown only slightly—from 49 percent in 1955 to 53 percent in the fiscal year which has just ended—the more than threefold absolute increase in the total Federal medical-research appropriation from $118 million to $380 million has greatly complicated the task of the agencies responsible for administering these funds.

The difficulties inherent in the very rapid expansion of a program, such as the review and award of research grants, which entail a multitude of technical and administrative detail, have been a matter of particular concern for the National Institutes of Health.

INCREASED ROLE OF NIH

While the medical-research expenditure of all the other Federal agencies rose from $59 million in 1955 to $96 million in 1960, the NIH research budget increased almost fivefold from $59 million to $284 million. This is quite apart from the increase in training funds from $14 million to $90 million during the same period. As a result, NIH has become the largest single source of medical-research support in the Nation—and, indeed, in the free world.

Its policy decisions, and even the cumulative effect of its routine administrative actions, now have a significant impact not only on the course of the Nation's medical-research effort but on the training provided by medical schools—and, increasingly, by university bioscience departments as well—and on the deployment of trained manpower in the bioscience field.

A Federal agency which administers a research budget that has come to represent 40 percent of the total national expenditure on medical research clearly has responsibilities that extend far beyond merely insuring that the public funds entrusted to its care are properly managed.

THE BASIC PROBLEMS OF PROGRAM DIRECTION

The accelerated rate of growth has inevitably created or aggravated problems in connection with the planning, the coordination, and the direction of the research programs. The problems relate, on the one hand, to various aspects of the internal decision-making process of a single agency, and, on the other, to communication and the coordination of programs among the various granting agencies.

There is thus a real need to review the nature of these processes and the role which analytical materials can play in carrying them out.

All those concerned with the review of extramural grants and with the administration of intramural research will welcome any devices or procedures which will help them in the intelligent discharge of their responsibilities.

The development and direction of a national research support program involves, in general, two basic sets of decisions. The first group of decisions relates to the factors influencing an individual investigator in the direction of his efforts.

The second set of decisions constitutes the processes involved in managing a research program at a national level.

One, I believe, cannot discuss the latter without first discussing the former.

FACTORS INFLUENCING THE INDIVIDUAL INVESTIGATOR

As in all basic research fields, the investigator has an infinite number of avenues open to him. Despite the tremendous advances made in recent years in our understanding of biological processes, the areas of ignorance in the biomedical sciences are still so extensive that it is impossible to predict where the next breakthrough or even the most useful accumulation of work-a-day knowledge is likely to occur.

The search for fundamental knowledge which will clear the way for the conquest of many common diseases that scourge mankind is, in the final analysis, best promoted by providing the terms and condition of support for the individual investigator which engender the maximum probability of productive return.

The individual scientist's selection of a project is largely determined by the interplay of his natural curiosity and predilections, his special talents or technical skills, the focus of his previous training and experience, his personal assessment of the needs and opportunities in his field, and the facilities and research materials that are available to him in the environment in which he happens to be working.

This is especially true of clinical research in which a project frequently grows out of attempts to solve practical problems encountered in medical practice or is specially designed to take advantage of an unforeseen opportunity to study a particular disease, pathological condition or type of patient.

NEED FOR FREEDOM FOR SCIENTISTS

Senator HUMPHREY. May I interject at this point that this committee appreciates the description which Dr. Shannon is providing as to the interests of individual working scientists.

I might add that we have studied the problems, interests, and habits of scientists about as closely as has any group in the Congress. We want to afford scientists the broadest possible latitude in making their choice of research projects, consistent with the statutory mandate to the supporting agencies.

As a matter of fact, we believe that the scientist will have a broader choice if he is given more information as to various current alternatives, based on what others are and are not doing.

In any event, no one would assert more strongly than we would that the scientist must have freedom of choice in making up his mind in his own way. He must not be forced into a rigid mold or line of research. He must be able to work creatively in an atmosphere of freedom. He must not be bothered with unnecessary reports, either to prepare them or to read them. He must have time to work and to think.

But at the same time, we think that there must be placed at his disposal certain tools. And few tools are more valuable than information. I refer to information which he really needs, when he needs it, and in the way he needs it.

This applies to physical sciences and life sciences or any science. We have had much experience with all of them. In the two hearing appendix volumes which will be issued shortly by this subcommittee, there will be reproduced some of the literally hundreds of letters we have received from research scientists in biology, medicine, physics, and chemistry all over the world.

We contacted, for example, every living winner of the Nobel Prize in physiology and medicine.

So when we ask questions about what scientists might be able to use when they make up their minds, we base our inquiries on a background of considerable contact with men of science.

Please continue, Dr. Shannon.

PROBLEMS OF STORING AND RETRIEVING DATA

Dr. Shannon. Within this framework of factors affecting a scientist's choice, his selection of a particular research project and his plan of attack derive, first, from information gleaned through his personal contacts with colleagues in the same or related fields, through his attendance at professional meetings, and from literature, and, second, from the availability of support under terms which provide the best conditions for work.

With the rapid expansion of the national—and, indeed, the international—volume of research and the proliferation of resulting publications, the task of keeping abreast of developments has become increasingly cumbersome and time consuming.

There is an urgent need for better information storage, retrieval, and communication systems to shorten the timelag between a laboratory finding and its communication to other scientists, to reduce the number of sources that need to be consulted, and to make the stored data more readily accessible.

Such systems, however, relate to the results of completed work. A scientist planning or embarking on a research project has relatively little use for classified and collated descriptions of other scientists' intended activities or for statistical summaries portraying the distribution of the national research effort.

THE DECISION-MAKING PROCESS AT THE PROGRAM LEVEL

Data on active and prospective research projects is, however, very useful to grant-program administrators. It is, first of all, an essential tool in the review process. The granting agency needs to know what support or promises of support the investigator enjoys. The proper stewardship of public funds requires an assurance that the investigator is not receiving duplicate awards for the same work from different sources and that excessive commitments are not made to several granting agencies for common resources.

The information about an applicant's current and prospective grant support from all known sources which the Bio-Sciences Information Exchange routinely supplies to our study sections and councils is clearly indispensable for this purpose.

In fact, it was to make such a service available to all Federal agencies that the Bio-Sciences Information Exchange was originally set up in roughly its present form. I am sure that the representatives of other granting agencies will agree that for this important purpose the system works superbly well.

MULTIPLE ATTACKS ON A PROBLEM

We need be less concerned about what might appear to be the possibility of duplication of awards in the same scientific area to different investigators.

A careful distinction must be drawn between duplication of effort—a phrase which implies needless concentration and waste—and multiple attacks on a scientific problem. There is not only no harm in supporting more than one investigator for the same type of work but there is positive value in supporting a multifaceted attack upon a single major research problem. It would certainly be highly inimical to progress if Federal agencies acted on the premise that the investigator (or even a considerable number of early-bird investigators) who had succeeded in obtaining a grant had established an exclusive claim to research support for a particular problem or subject area.

UNDERSUPPORT MORE LIKELY THAN OVERSUPPORT

On a broader basis, statistical analyses are of inestimable value in assessing the trends of research, in measuring the scope of the attack on major disciplinary problems, and in identifying possible neglected fields or deficit support areas.

I should like to emphasize that in the present state of medical research an imbalance of effort is more likely a consequence of undersupport than oversupport of any area of research inquiry.

Although the character of the flow of grant applications is conditioned by the cumulative decisions of individual investigators, the granting agency and its scientific advisers can give practical expression to program policies through the process of selecting projects for support.

This is not to say that each application for NIH support is selected on the basis of its conformity to a master research plan, but positive steps can, and are, taken to stimulate work in neglected fields, to initiate new lines of investigation, and to shift the distribution of effort in accordance with emerging needs and opportunities.

Analytical materials are generally of substantial assistance in this process, but essential, important, and useful as these may be, there are other mechanisms which also contribute to this process of administration.

ROLE OF STUDY SECTIONS

Particularly significant in contributing to the direction of our research support programs is the role of the study sections—our scientific review groups—and comparable groups in other agencies.

In addition to their primary function of assessing the scientific merit of grant applications and the competence of applicants, the study sections are continually surveying the needs and opportunities of their respective disciplinary areas.

Discussion of these broad problems is not confined to the thrice-a-year meetings of the study sections but frequently involves consultation with other leaders in the field or the sponsorship of conferences and symposia attended by experts from all over the country, and frequently with international participation.

I should be glad to provide for the record a list of 136 such conferences of which 79 were held during the past 4 years.

Senator HUMPHREY. The list of conferences would be very useful and will appear at this point in the record. I might note that only a scientific study could determine to what extent those who attended the conferences may have thereafter disseminated the information to the vast numbers of potential conferees who did not attend.

EXHIBIT 4

Conferences and Symposia Sponsored by Study Sections and Division of Research Grants 1947–60

FISCAL YEAR 1947

	Topic	Dates
Antibiotics SS	Recent Advances in Antibiotics	Jan 31–Feb. 1, 1947.
Syphilis SS	Recent Advances in the Study of Venereal Diseases	Apr. 17, 1947.

FISCAL YEAR 1948

Sanitation SS	Water, Sewage, and Industrial Wastes	June 14–15, 1948.
Syphilis SS	Recent Advances in the Study of Venereal Diseases	Apr. 8–9, 1948.

FISCAL YEAR 1949

Antibiotics SS	Recent Advances in Antibiotics	Apr. 11–12, 1948.
Bacteriology SS	Histoplasmosis	Sept. 13, 1948.
Cardiovascular SS	Water and Electrolyte Metabolism in Cardiac Edema.	Apr. 30, 1949.
Dental SS	Oral Flora, Dental Caries, and Gingival Disease	Jan. 14–15, 1949.
Sanitation SS	Recommended Research: Milk and Food Sanitation	Jan. 26–27, 1949.
Sanitation SS	Water, Sewage, and Industrial Wastes	June 23–24, 1949.
Surgery SS	Peptic Ulcer	Sept. 24, 1948.
Syphilis SS	Recent Advances in the Study of Venereal Diseases	Apr. 7–8, 1949.
Tropical Medicine SS	Schistosomiasis	Jan. 31, 1949.

FISCAL YEAR 1950

Dental SS	Periodontal Disease	May 19, 1950.
DRG	Publication of Monographs	Oct. 20, 1949.
Environmental Health SS	Polluted Irrigation Water	Jan. 27, 1950.
Exper. Thera. SS	Recent Advances in the Study of Venereal Diseases	Apr. 27–28, 1950.
Hematology SS	Blood Groups and Antibodies	Jan. 13–14, 1950.
M and E SS	Adrenal Cortex	Sept. 19, 1949.
Micro. and Imm. SS	Brucellosis	Sept. 22–23, 1949.
Public Health Res. SS	Methods in Public Health Research	May 10–11, 1950.
Surgery SS	Surgical Aspects/Cardiovascular Research	Jan. 21, 1950.

SS—Study Section.
SSs—Study Sections.
A and I—Allergy and Immunology.
BBC—Biophysics and Biophysical Chemistry.
DRG—Division of Research Grants.
Exper. Thera.—Experimental Therapeutics.
HED—Human Embryology and Development.
HFR—Hospital Facilities Research.
M and E—Metabolism and Endocrinology.
M and G—Morphology and Genetics.
M and N—Metabolism and Nutrition.
Micro. and Imm.—Microbiology and Immunology.
NINDB—National Institute of Neurological Diseases and Blindness.
P and T—Pharmacology and Experimental Therapeutics.
PET—Pharmacology and Experimental Therapeutics.
PH and Sanitation—Public Health and Sanitation.
PHR—Public Health Research.
Public Health Res.—Public Health Research.
SD and Micro.—Sensory Diseases and Microbiology.
SEOH—Sanitary Engineering and Occupational Health.
TM and P—Tropical Medicine and Parasitology.
TMP and VR—Tropical Medicine and Parasitology
Virology and Rickettsiology.
V and R—Virology and Rickettsiology.

Conferences and Symposia Sponsored by Study Sections and Division of Research Grants 1947–60—Continued

FISCAL YEAR 1951

	Topic	Dates
Exper. Thera. SS	Recent Advances in the Study of Venereal Diseases.	Apr. 24–25, 1951.
Surgery SS	Metabolic Disturbances during Surgical Care	Jan. 12, 1951.

FISCAL YEAR 1952

Cardiovascular SS	Cinefluorography	Jan. 7, 1952.
Exper. Thera. SS	Recent Advances in the Study of Venereal Diseases.	May 1–2, 1952.
M and G SS	Microspectrophotometry of Cells	Sept. 28–29, 1951.
Surgery SS	Artificial Heart-Lung Mechanisms	Sept. 7, 1951.
Surgery SS	Blood Vessel Grafts	Jan. 10, 1952.
Tropical Medicines SS	Problems and Responsibilities in Serologic Diagnosis of Toxoplasmosis.	Aug. 3, 1951.
Tropical Medicine SS	Research Needs in Tropical Medicine	Sept. 28–29, 1951.

FISCAL YEAR 1953

Dental SS	Saliva	Sept. 19–20, 1952.
Exper. Thera. SS	Recent Advances in the Study of Venereal Diseases.	Apr. 30–May 1, 1953.
Hematology SS	Hemoglobin Abnormalities	Jan. 6, 1953.
M and G SS	Tissue Transplantation	Oct. 7–8, 1952.
NINDB	Retrolental Fibroplasia	Nov. 2, 1952.
Tropical Med SS	Toxoplasmosis	July 7, 1952.
Tropical Med SS	Research Needs in the Field of Tropical Medicine	Jan. 5, 1953.

FISCAL YEAR 1954

Cardiovascular SS	Ballistocardiography	May 1, 1954.
Hematology SS	Critical Evaluation of Certain Methods in the Study of Hemolytic Anemia.	Jan. 7, 1954.
Medical Zoology SS	Research Status and Needs in Medical Zoology	Apr. 26, 1954.
M and G SS	Problems and Methods in Human Genetics	Oct. 8–9, 1953.
Pathology SS	Research Potential: Pathology	Jan. 16–17, 1954.
Physiology SS	Fundamental Problems in Physiology	Oct. 29–30, 1953.
PH and Sanitation SS	Workshop Conference on Air Pollution	Jan. 15, 1954.

FISCAL YEAR 1955

Hematology SS	Control of Red Cell Production	Jan. 7, 1955.
M and G SS	Conference on Experimental Hepatomas	Oct. 11–13, 1954.
P and T SS	Conference on Granulomatons Uveitis	Dec. 13, 1954.
Physiology SS	Plan for Cooperative Research Project	July 9–10, 1954.

FISCAL YEAR 1956

BBC SS	Present Status of BBC in the U.S.	Sept. 16, 1955.
BBC SS	Present Status of BBC in the U.S.	Dec. 1, 1955.
H.E.D. SS	First Conference on Teratology	Jan. 12–13, 1956.
M and N SS	Tracer Isotopes in Metabolic Research	Apr. 19, 1956.
M and G SS	Tissue Fine Structures	Jan. 16–18, 1956.
PET SS	Potential Objective Criteria for Evaluation of Cancer Chemotherapy in Man.	Oct. 10–11, 1955.

FISCAL YEAR 1957

A and I SS	Immunology and Cancer	Jan. 4–5, 1957.
BBC SS	Present Status of BBC in U.S.	Sept. 22, 1956.
BBC SS	Nuclear and Paramagnetic Resonance	May 2, 1957.
Endocrinology SS	Insular Action	May 5, 1957.
Hematology SS	Hemoglobin(s)	May 2–3, 1957.
HFR SS	Committee on Symposia	Feb. 25, 1957.
HED SS	Second Conference on Teratology	Apr. 15–16, 1957.
M and N SS	Insular Action	May 9–10, 1957.
Physiology	Research and Training Needs in Physiology	June 30–July 1, 1957.
Radiation SS	Research in Radiology	May 10–12, 1957.
Radiation SS	Patient Exposure to Diagnostic X-Ray	May 25–26, 1957.
SD and Micro SSs	Viral Keratoconjunctivitis	Sept. 7–8, 1956.

Conferences and Symposia Sponsored by Study Sections and Division of Research Grants 1947–60—Continued

FISCAL YEAR 1958

	Topic	Dates
BBC SS	Certain Fundamental Aspects of Biophysical Science.	Jan. 15–16–17, 1958.
Endocrinology SS	Hormone Assay Subcommittee	Feb. 15, 1958.
Endocrinology SS	Hormones and Atherosclerosis	Mar. 11–14, 1958.
General Medicine SS	Fundamental Problems in Ulcerative Colitis	Jan. 6, 1958.
HFR SS	Joint Meeting with Assn. of Western Hospitals	Oct. 14, 1957.
HFR SS	Joint Meeting with Hospital Representatives from Minnesota, Illinois, Michigan, Wisconsin, and Indiana.	Feb. 21, 1958.
HED SS	Epidemiological Approach: Problems of Pregnancy Wastage.	May 23–25, 1958.
Microbiology SS	Influenza Research	Oct. 29, 1957.
Microbiology SS	Hospital Infections	Apr. 17, 1958.
M and G SS	Genetics in Medical Research	Apr. 7–10, 1958.
Nursing Research SS	Committee on Nursing Research Conferences	July 30–31, 1957.
Nursing Research SS	Committee on Planning Nursing Research Conferences.	Nov. 23, 1957.
Nursing Research SS	Special Clinical Training Needs in CV Nursing	Jan. 11, 1958.
Nursing Research SS	Committee on Research Training	Apr. 12, 1958.
Nursing Research SS	Research Training for Nurses	Apr. 28–30, 1958.
Pathology SS	Nutritional Pathology	June 1–5, 1958.
Pathology SS	Use of Experiments in Undergraduate Teaching of Pathology.	June 16–20, 1958.
Radiation SS	I–131	July 30, 1957.
Radiation SS	Cooperative Studies in Radiation Therapy	July 27–28, 1957.
Radiation SS	Cooperative Studies in Radiation Therapy (Subcommittee).	Sept. 7, 1957.
Radiation SS	Cooperative Studies in Radiation Therapy (Subcommittee).	Oct. 6, 1957.
Radiation SS	Cooperative Studies in Radiation Therapy	Nov. 17–18, 1957.
Radiation SS	Cooperative Studies in Radiation Therapy (Subcommittee).	Dec. 8–10, 1957.
Radiation SS	Cooperative Studies in Radiation Therapy	Jan. 11–12, 1958.
Radiation SS	Cooperative Studies in Radiation Therapy	May 17–18, 1958.
Radiation SS	Cooperative Studies in Radiation Therapy (Subcommittee).	Feb. 28–Mar. 1, 1958
SEOH SS	Workshop Conference on Air Pollution	Jan. 8, 1958.
SEOH SS	Man Versus Environment	May 5–6, 1958.
Sensory Diseases SS	Symposium on Visual Mechanism	Sept. 11–12, 1957.
Surgery SS	Artificial Hear-Lung Mechanism	Sept. 20–22, 1957.

FISCAL YEAR 1959

Behavioral Sciences SS	Performance Test of Personality	May 20–22, 1959.
BBC SS	Biophysical Science	July 20–Aug. 16, 1958.
Dental SS	Caries Diagnosis and Experimental Caries	Sept. 4–5, 1958.
Endocrinology SS	Paradoxical Ovarian Structure and Function	Dec. 12–13, 1958.
Hematology SS	Fundamental Problems and Techniques for the Study of the Kinetics of Cellular Proliferation.	Jan. 19–21, 1959.
Inter-Study Section	Staphylococcus Infections	Aug. 28–29, 1958.
Inter-Study Section	Viruses in Relation to Human Malignancies	Sept. 16, 1958.
M and N SS	Effects of High Calcium Intake	Apr. 14, 1959.
Nursing Research SS	Committee on Research Training	July 31, 1958.
Pathology SS	The Chemical Organization of Cells, Normal and Abnormal.	Aug. 21–23, 1958.
Pathology SS	Electron Microscopy	May 7, 1959.
PET SS	Catechol Amines	Oct. 16–18, 1958.
PHR SS	Planning Committee—Human Population Laboratories.	June 13, 1959.
Radiation SS	Tissue Oxygen Tension and Radiotherapy	Aug. 16–17, 1958.
Radiation SS	Cooperative Studies on Carcinoma of the Lung	Dec. 31, 1958.
Radiation SS	Cooperative Studies on Carcinoma of the Lung	Apr. 5, 1959.
SEOH SS	Workshop Conference on Food Technology	Jan. 14, 1959.
TMP and VR SSs	Steering Committee Meeting on Research in Bat Rabies.	Mar. 30, 1959.

Conferences and Symposia Sponsored by Study Sections and Division of Research Grants 1947–60—Continued

FISCAL YEAR 1960

	Topic	Dates
Dental SS	Clinical Estimation of Caries Incidence and Increments.	Sept. 21–24, 1959.
Dental SS	Congenital Anomalies of the Face	Dec. 6–9, 1959.
Endocrinology SS	Human Pituitary Gonadstropin	Dec. 3–5, 1959.
Genetics SS	Methodology in Human Genetics	May 13–14, 1960.
Metabolism SS	Insulin Bioassay Seminar	Jan. 21, 1960.
Nursing Research SS	Curriculum Research	Nov. 15, 1959.
Nursing Research SS	Curriculum Research	July 10–11, 1959.
Nutrition SS	Workshop on Bone Densitometry	Dec. 4–5, 1959.
Nutrition SS	Interaction of Mineral Elements in Nutrition and Metabolism.	Apr. 13, 1960.
Nutrition SS	Problems of Nutrition Appraisal of Man	Apr. 13, 1960.
Pathology SS	Immunopathology	Sept. 24, 1959.
Pathology SS	Germ-Free Techniques	Jan. 27, 1960.
SEOH SS	Planning Committee—Conferences on Physiological Aspects of Water Quality.	Sept. 17, 1959.
SEOH SS	Waste Water Reclamation and Reutilization	Jan. 4, 1960.
Toxicology SS	Symposium on Foods: Enzymes	Sept. 9–10, 1959.
Toxicology SS	Symposium on Problems in Toxicology	Apr. 13, 1960.
TMP and VR SS	Research in Bat Rabies	July 10–11, 1959.
TM and P SS	Steering Committee on Third Conference on Research Needs in Medicine in the Tropics.	Nov. 5, 1959.
V and R SS	Symposium on Tumor Viruses	Mar. 25–26, 1960.

LARGE ATTENDANCE AT CONFERENCES

Dr. SHANNON. The value which the scientific community attaches to these conferences was dramatically illustrated by a 3-day session on catechol amines sponsored by the Pharmacology and Experimental Therapeutics Study Section which drew no less than 800 participants.

If I could pause here for a minute, Senator Humphrey, I think that while this large attendance—surprisingly large attendance for what was to be a working conference—emphasizes dramatically the importance of these conferences, it also highlights a need because these 800 people felt that the conference might make them aware not only of work which had been published, but of work which was currently underway.

I think that these conferences have a twofold significance: on the one hand, they satisfy a need; on the other hand, they indicate a need which has not been satisfied by our routine processes of information.

NIH OFFICERS' ROLE IN PROFESSIONAL SOCIETIES

The staffs of the several institutes also keep well abreast of developments in their respective fields. Let me enumerate, by way of example, some of the activities in which the staff of the National Cancer Institute participate, all bearing on program selection.

They hold key positions in professional societies, including the International Union Against Cancer, travel extensively abroad and carry out constant correspondence with investigators active in this field around the world. The annual meetings of the Association of Cancer Research are attended by almost every investigator active in this field, including many of the Institute's scientists and program directors.

Every fourth year the institute sponsors, with the American Cancer Society, a National Cancer Congress, and every 4 years it also participates in the International Cancer Congress.

As publishers of the Journal of the National Cancer Institute, which has become a leading cancer periodical, the staff receive and review manuscripts from investigators all over the world.

Without doubt the subject matter data compiled by the BSIE and the fairly elaborate index control systems which some of the institutes maintain constitute valuable supplements to the firsthand information of the study sections and institute staffs in guiding program development. These statistical measures of trends and developments serve to crystalize and present in broad quantitative terms the impressions gathered through traditional professional channels.

USE OF SUMMARY DATA AT THE NATIONAL LEVEL

Collated information on the distribution of the Nation's medical and biological research effort also has an increasingly important role to play in the administration of national programs.

When these research activities are viewed in panoramic terms, summary statistics become a most helpful index of the relative balance of work being done in major disciplinary and categorical areas.

A careful assessment of such data can be the basis for intervening in the processes that affect the distribution of activity in order to influence the direction of effort and the division of resources.

Such intervention, however, is a delicate task which can be successfully undertaken only with respect to very broad program emphases.

GROWTH OF PHYSICAL BIOLOGY

The decision of NIH to launch a large-scale developmental program in the field of physical biology—involving not only the expansion of research support but also of research-training in this area—is a case in point.

This decision had its origin in: (1) an appraisal of the developing areas of biological research which showed that there was rapidly increasing interest in the chemistry of large molecules and in matter and energy interchange within the cell, and the physical basis of such processes—that is, the micro-structure itself; (2) an assessment of advances made in the physical sciences in precision measurement and in instrumentation which were applicable to these biochemical problems; and (3) a study of trends in university research programs as reflected in discussions with knowledgeable biologists and in quantitative analyses of incoming grant applications which showed a growing tendency to depart from what heretofore had been traditional research areas.

In reaching a policy decision affecting this broad area of scientific activity, an examination of summary statistics of trends in research effort was of great help. In fact, it was essential as a basis for decision.

SUMMARY PROGRAM REVIEW

Summaries of research support by subject and by supporting institute or agency were also essential to a plenary review of the NIH research programs undertaken on the accession of a new Secretary of the Department.

Departmental concern with the orderly development and adequate budgetary support of NIH research programs required a careful field-by-field examination of research needs, opportunities, and recent developments and the relationship of the NIH program in each field to the support given by other agencies.

Such a review would have been wholly inadequate without the detailed data supplied by the BSIE showing NIH-supported activities in relation to the programs of other Federal and non-Federal agencies.

GRANTS TO RESEARCH CENTERS

More recently, planning for the development of research centers has involved a detailed examination of the extent to which each of the component institutes supports individual departments of universities and research institutions. This information, derived from BSIE tabulations, provides a factual framework for considering the advisability of developing centers in specific institutions and will also facilitate a more effective rearrangement of support for departmental research programs in relation to the major program objectives of NIH.

USE OF DATA BY COUNCILS

Broad, comprehensive statistical data of this kind are clearly an essential management tool. They are also of growing importance to the advisory councils which—to a much greater extent than the study sections—are concerned with fundamental policies and broad program direction.

Until a few years ago the personal knowledge of council members and the other informational devices available seemed adequate but it became clear to me 2 years ago that analyses of the type prepared by the BSIE were needed if the councils were to be fully informed about the total national effort.

Statistical summaries are therefore now being routinely supplied at each of the council meetings. It is hoped that they will not only assist the councils in selecting areas for greater program emphasis but that they will be useful, at subsequent meetings, to determine the effectiveness of measures taken to correct program deficiencies.

In addition to supplying essential data for project review and program planning, summary analyses derived from BSIE information might play a larger part than has been asked of it heretofore in interagency communication. Coordination is to some extent accomplished through the normal budget process which takes into account the related programs of the various Federal agencies.

There is also fairly extensive interagency cooperation through both formal and informal contacts at the technical level. Scientists working on related projects are in constant touch with each other and there is good administrative liaison through agency representation on NIH councils and by ad hoc conferences.

A comprehensive overall view of the total Federal program can, however, be more effectively provided by a central mechanism such as the BSIE.

While this will necessarily have to be in rather broad terms, it is, I believe, essential for a substantive review of the direction and emphasis of Federal programs, and to any assessment of the total effect

of Federal support programs on educational institutions, hospitals, private research organizations, and industry.

As medical research continues to grow, NIH will rely more heavily on the BSIE for summary presentations of Federal and national research activities in general and in selected fields.

It is hoped, therefore, that coverage can be expanded and processing of the data adapted, as may be necessary, to provide a wider range of reports useful for policy planning. I suggest that one of the more important topics that might be discussed at this hearing and, hopefully, at future interagency meetings, is the kinds of information that might be effectively used in planning or in carrying out an agency's research mission, and how much of this information can be effectively supplied by the BSIE.

LIMITATIONS OF ANALYTICAL MATERIALS

We must, of course, recognize that there are practical limitations to what can be achieved through a central organization, and, indeed, to the purposes which can be served by statistical compilations.

It is especially important to remember that program decisions in a highly diversified field such as medical research cannot be made solely on the basis of the recorded intentions of grant applicants or the projected plans of other agencies or institutions.

Moreover, each research organization must tailor its program to its own special capabilities, facilities, and opportunities, and must make its own value judgments.

There are also serious practical difficulties inherent in the centralized approach. For example, no single system can adequately codify all the varied programs or reduce them to the common terms needed for a unified picture of the collective effort.

It is certainly desirable to have interagency agreement on common procedures and classification systems for certain broad categorizations, so that commonly useful data can be supplied on request to other Federal agencies and to non-Federal groups interested in the support of medical research.

But serious problems arise in attempting to make any detailed classification meaningful enough to be technically useful at the laboratory level.

DIFFICULTIES IN REPORTING INTRAMURAL RESEARCH

There is a similar difficulty in the segmentation, for statistical purposes, of the work done in a laboratory or clinical research facility into separate research projects. Arbitrary decisions must necessarily be made by the responsible laboratory chiefs and there can be no assurance that these will be made on a comparable basis.

The latter is one of the difficulties which besets the reporting of NIH intramural research programs to the BSIE. Project titles and investigators' names covering NIH activities during 1958 were, in fact, transmitted to the BSIE. These apparently proved unsuitable and after further discussion with Dr. Deignan, the feasibility of supplying the data in a different form will be reviewed.

A major and obvious difficulty to be met is maintaining the currency of information in an area of rapid growth and change.

This is necessarily a rather brief and incomplete exposition of what is, in all truth, a very complex and difficult subject.

The major point I should like to emphasize is that in the overall process of administering Federal research programs statistical data about current research is an essential management tool and is becoming increasingly important.

It is, however, best adapted to the gross measurement of the medical research efforts. It is of limited usefulness in detailed technical direction of research activities but is an indispensable component in the process of guiding general program development and in relating the activities of the several national agencies in this field.

We are endeavoring to enlarge the role and increase the usefulness of such materials as NIH operations. We believe that greater exchange of such summary materials amongst the several agencies in the biomedical research field will contribute generally to improved program planning and direction for all agencies.

ANALYSIS BY DIVISION OF RESEARCH GRANTS

I would like to make only one very practical comment at this point: That on reading this—in its preparation it escaped me, but I think it is very worthwhile bringing out—these decisions were largely reached by our staff fully 2½ years ago.

We felt that we had to reorganize our own analytical tools so that we, in turn, could have better management guides derivable from such studies.

We felt that we were not in a position to impose this need on an outside agency until we had clarified the mechanics and techniques by which we would satisfy ourselves.

STUDY BY DIVISION OF RESEARCH GRANTS

Pursuant to that decision, we set up within our Division of Research Grants a fairly broad-scale analytical program with very competent leadership, very hard work, and at no small cost.

It took a year and a half before we felt that the thing was finally rolling and rolling smoothly. So I point out that the introduction of statistical processing, analytical tools, and things of this general sort, as guidelines in the determination of agency policy and in developing these as administrative tools to guide agency decisions, are not something that can be undertaken lightly, however important they are; or that results can be expected too early, because I can just point to a 2½-year sizable, concentrated effort on our part, and I think we are finally in a position now for the program to roll.

I would say, furthermore, that when one talks about this type of information, it has importance far beyond the simple support program.

In our case we feel that the information we will now get from a statistical analysis of our operation, and through BSIE of the Nation's operation, is the most important information we can have in guiding the development of our training programs, which will determine in no small measure the research competence in the future, in addition to the research that is currently undertaken.

So I can't overemphasize how strongly we feel concerning the importance of these.

I think we know from our own experience, having appreciated this considerably in the past, how hard it is to develop these to the point where they are more than very blunt instruments. When one approaches a delicately balanced program with a blunt instrument, one is apt to do more harm than good, and it literally has taken us this time to get to the point where we feel that now we can depend upon this type of information in determining our program decisions.

Thank you very much, sir.

IS DUPLICATION KNOWING OR UNKNOWING

Senator HUMPHREY. Thank you very much, Dr. Shannon.

Just one or two general observations.

The point that you made in reference to duplication, I think, is well presented in your statement.

Our concern here is not so much that there may be one, two, three, or four scientists or researchers working in the same field, because that may be required. It may be, in fact, very highly desirable and essential.

But the point of concern, at least for me, is first, whether or not the respective researchers who are engaging in somewhat parallel projects have any idea at all of what had transpired thus far and is now transpiring in that particular area, and second, whether or not those who were making the decision for the grant were, as you put it, assessing this grant on the basis: Is this an overworked area, or an underworked area?

In other words, how well do you use the limited resources you have? You may have a vast number of projects going into one particular field of endeavor.

Let's take an area in which I have had some interest out in my home State, ulcerative colitis, just using it now as an example without any professional knowledge particularly of it.

Let's assume that new grants are being made for research in this field and that the current research, which has been underway within the last year, has never been either analyzed, written, published, or summarized.

It is entirely likely—or at least, it is a possibility—that some of the answers may have already been determined, or some negative results already experienced.

COMMITTEE'S WORK IN DOCUMENTATION

Now I give this as a background because we have in this committee, under the staff direction of Mr. Reynolds and with the aid of other members of his staff, gone into this whole field of storage, abstracting, indexing, and retrieval of information, translation, including mechanical translation, and so forth.

We have been doing a lot of work in that area, as you know.

How many years, Walter? About the last 6?

Mr. REYNOLDS. At least that. But primarily in the last 3 years.

Senator HUMPHREY. We started, I think, about 5 years ago. In the last 3 years particularly, as a result of the Soviet challenge in this field, we have concentrated the investigatory aspects of this committee and subcommittee into the field of storage and retrieval of information, especially electronic manners in which this can be done.

I think we have made some progress which has been helpful with the agencies. But that is basically for published material—i.e., on research which has been completed.

We are now talking about current research that is unpublished. In this area, I have a couple of questions on your testimony.

WORK BY DIRECTOR OF PROJECT

I am going to suggest to my colleagues, if there is no objection, that we might have Mr. Cahn ask some questions on this, since he has done the basic research and background.

I have spent a good deal of time with him in getting acquainted with some of the preliminary discussions that he has had with many of you represented here this morning. As you know, you may have almost been harassed at times by me with a barrage of letters asking for information. And I might say that in the main those letters have been readily responded to.

But there are a few of them that are still unanswered, and we will be after you again in a most pleasant and friendly, but firm, manner, because I think the information that we are seeking is very important.

INTERRELATIONSHIPS AMONG AGENCIES

From these letters and from our other inquiries, we have noted a pattern of interrelated activity among the Federal agencies in biomedical research. The pattern is interrelated because nature itself is interrelated. We see quite clearly that the thrust of scientific study of nature cannot be contained within artificial boundaries. Scientists' curiosity takes them down unforeseen trails and with unforeseen results.

Each Federal department, agency, and institute may start out its scientific research with somewhat different intent in order to carry out its particular legal mandate. But there is no way of predicting end results or byproducts or side trails. And the fields of interest are shared to some extent, to begin with. This is not an unsatisfactory situation, in my judgment. On the contrary, I, for one, believe that it is a very salutary thing to have multiple sources of interest and sup-

port. But the existence of such multiple sources requires that there be coordination of information.

It should be noted that as far back as the first Hoover Commission in 1949 (see app. A), it was noted that health functions, including research, were scattered among many Federal agencies. The opinion was repeatedly expressed by the Commission, however, that it is far better to continue to operate such programs as part of the respective missions of the various agencies than to attempt to centralize them in any one agency.

Coordination of the various activities was, however, stressed. The first Hoover Commission, like the second Commission made a specific point of emphasizing that a degree of scientific duplication not only cannot be avoided but is actually desirable in many instances.

Now, in order to make clear the parallel or, as it might be put, at least to a limited extent, the overlapping activities of the agencies, I asked the staff to draw up a chart. It follows as an exhibit, along with an important explanatory note.

EXHIBIT 5

CHART ON OVERLAPPING AND RELATED INTERESTS OF FEDERAL AGENCIES IN BIOMEDICAL RESEARCH

NOTE.—This chart is designed merely to indicate that a certain number of research projects supported by Federal agencies may overlap to some extent with one another as regards general area of interest. No scientific study has been made as to the actual degree or amount of overlapping within such general areas. No scientific study, moreover, has been made as to the extent to which actual duplication of given projects may occur, if at all. Scientists commenting to the committee have indicated that actual duplication by one agency of a project of another is probably very rare, if it occurs at all, since the diversity of projects in any one field or subfield is so vast.

Center circle.—The National Institutes of Health are used as a "base" for the circles within the chart since they have the principal statutory mandate for biomedical research and since they receive the overwhelming proportion of Federal biomedical research funds.

Further interrelationships.—A more complicated three-dimensional chart would be required to show deeper interrelationshiups in the work of agencies. For example, a half dozen agencies, not merely NIH and the Department of Agriculture, are involved, if only in small part, in nutrition research. A half dozen agencies (including the three military departments) support some type of cardiovascular research (although all the others represent no more than a small fraction as compared with the volume of research by the National Heart Institute). In basic research, there is inevitably considerable overlapping in general subject matter. For example, a profound and fundamental problem, such as the process of photosynthesis, is being studied by or under support from the National Institutes of Health (National Institute of Arthritis and Metabolic Disorders), National Science Foundation, and other agencies.

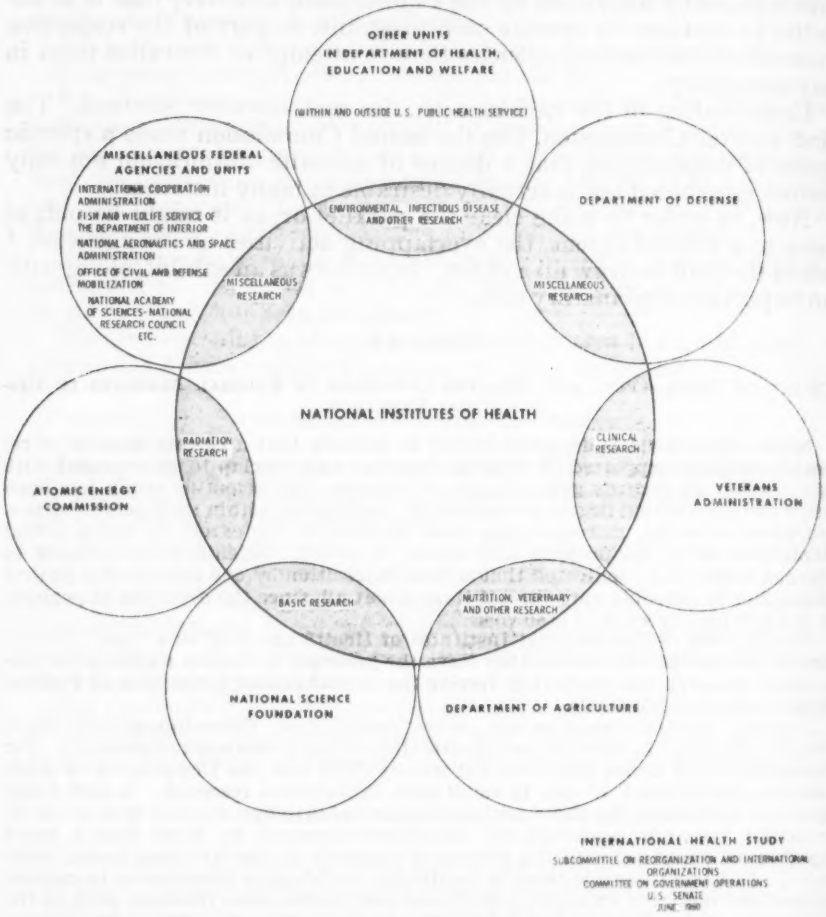
Summary.—This chart is, in effect, an effort to present in relatively simplified form one view of the various agencies' sharing of interests. The chart is not intended to convey anything more than general communities of interest in these fields.

Acknowledgment.—The subcommittee wishes to acknowledge the technical assistance in the drafting of this chart on the part of Mr. Robert Logan, Graphics and Special Presentations, Administrative Services, Office of Secretary of Defense. Similar assistance was extended in connection with exhibit 40. Contents for these various charts were compiled by the Project Director. As in the instance of other charts in which technical assistance was provided by NIH staff (see p. 210), the graphics work was performed in accordance with our detailed instructions as regards layout, etc. The respective agencies are therefore not responsible for the format or policy represented in the charts.

EXHIBIT 5

OVERLAPPING AND RELATED INTERESTS OF FEDERAL AGENCIES IN BIOMEDICAL RESEARCH

(USING NATIONAL INSTITUTES OF HEALTH AS A "BASE" ON WHICH TO DETERMINE THOSE AREAS OF EFFORT WHICH ARE RELATED TO ACTIVITIES OF OTHER UNITS AND AGENCIES)


OTHER UNITS IN DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
(WITHIN AND OUTSIDE U. S. PUBLIC HEALTH SERVICE)
MISCELLANEOUS FEDERAL AGENCIES AND UNITS
INTERNATIONAL COOPERATION ADMINISTRATION
FISH AND WILDLIFE SERVICE OF THE DEPARTMENT OF INTERIOR
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OFFICE OF CIVIL AND DEFENSE MOBILIZATION
NATIONAL ACADEMY OF SCIENCES- NATIONAL RESEARCH COUNCIL ETC.
ENVIRONMENTAL, INFECTIOUS DISEASE AND OTHER RESEARCH
DEPARTMENT OF DEFENSE
MISCELLANEOUS RESEARCH
MISCELLANEOUS RESEARCH
NATIONAL INSTITUTES OF HEALTH
RADIATION RESEARCH
CLINICAL RESEARCH
ATOMIC ENERGY COMMISSION
VETERANS ADMINISTRATION
BASIC RESEARCH
NUTRITION, VETERINARY AND OTHER RESEARCH
NATIONAL SCIENCE FOUNDATION
DEPARTMENT OF AGRICULTURE

INTERNATIONAL HEALTH STUDY
SUBCOMMITTEE ON REORGANIZATION AND INTERNATIONAL ORGANIZATIONS
COMMITTEE ON GOVERNMENT OPERATIONS
U. S. SENATE
JUNE 1960

PAST MEETING OF THOSE PRESENT

Senator HUMPHREY. Dr. Shannon, we have quite a few people here in the room this morning, and I would just like to ask this general question, whether the directors of biomedical research who are assembled here in this room have ever met previously as a group like this, but for the purpose of planning the Federal Government's biomedical research program. Are you aware of any such meeting?

Dr. SHANNON. I must confess, sir, I do not recall during my tenure of office such a meeting for the purposes of planning research.

Now, on the other hand, I can look to many, many meetings that we have had, the National Science Foundation, NIH, or AEC, to plan attacks on broad areas of biomedicine that obviously are of deep concern to our three agencies.

I can recall others with Agriculture—let me be very specific now—in fields of nutrition, in connection with the more recent information on possible effects of different types of fat in the diet relative to the predictable effect on blood vessel disorders.

We sit down and have extensive planning of this sort. I would say further that we frequently turn to the National Research Council to serve as an agent, to serve their function as well as ours, in developing conferences of technically oriented people to furnish information that is then made available to all agencies for purposes of planning.

So while I cannot recall having met with my counterparts of all the other agencies in meetings such as this, I think there is scarcely an agency or group of agencies that we have not met with very frequently in relation to quite broad problems.

Perhaps you might like to ask the others that question.

Senator HUMPHREY. We will come to them.

Dr. SHANNON. Yes.

COOPERATION ON GERM-FREE RESEARCH

So this requires some discrimination—could I give some very specific examples, sir, that give point to what I am saying?

There was a critical period at the time of the development of studies on germ-free life in the United States where one had to make a program decision whether this was ready to be broadened in its use or should be dropped. These studies had been supported by the Office of Naval Research over a period of some 10 years, quite generously and quite costly, with no payoff up to that time.

It seemed to some of us that this was at a critical point where support for another 5 years might well be required.

This led to a series of meetings at the National Research Council where certain general decisions were made, but these did not carry over into the hardheaded program planning of the agencies that had dollars and that were in a position to commit dollars.

I recall very clearly that I discussed this with Dr. Dunham, and we had in my office a meeting of every agency that had any interest in the field of germ-free life program planning. On a Saturday we spent some 4 or 5 hours and came out of that meeting with firm commitments for agency support at a certain dollar level and for certain purposes.

It is on the basis of that type of action, program work, that we now have a very broad program on germ-free life at the present time, set up in at least 5 areas in this country.

Now this is typical of how many of the problems are solved by Federal agencies.

I think that, in the 11 years I have been in Washington, I have been impressed by the thoughtfulness of the program directors that I have had to deal with, their real penetrating insight into broad problems, and while we had very violent disagreements at times, I cannot recall a time when they were unwilling to sit down or when I was unwilling to sit down and try to talk them through.

This is not to say, Senator Humphrey, that I am convinced that we have perfection in interagency coordination. I don't believe we do. I don't think that each of the Federal agencies, including our own, has enough information currently available to make certain program decisions it must make, and running a program is pretty much like running an army.

At critical times, even a fairly good decision is better than no decision. But a bad decision is certainly worse than no decision.

So that you not only have to appraise whether you have the facts upon which a decision can be made, but you have to appraise whether a decision should be delayed so that further facts could be accumulated, so that when the decision is made, it will be a sound one.

With the pressure continuously on you, you can't delay these decisions indefinitely, because you are dealing with a sensitive organism which, in the final analysis, is the research planning of this Nation.

Senator HUMPHREY. Doctor, the example that you give, I think, points up exactly one of the points that I have in mind.

This was an example; the meeting that you referred to was after the fact. The research had started, you said, in germ-free life?

Dr. SHANNON. Yes.

Senator HUMPHREY. And you had years of research and the decision had to be made as to whether we should continue or drop it.

Now the question might well be asked: Was there ever a general discussion among the research directors of the various agencies that were engaged in biomedical research concerning the whole picture of research in germ-free life?

POSSIBILITY OF COORDINATIVE MECHANISM

Let me get down to cases here. In my preparation I have developed this kind of question: Do you think it would be a good idea to have some kind of continuing arrangement—not this sporadic, emergency arrangement, but continuing arrangement—whereby research directors of the various agencies would get together at this high policy level—I am not talking about down at the technician level in the laboratory but the high policy level—for the big view of trends in one another's programs that are interrelated; for example, trends in Government-wide research on the aging? Now there are several agencies here today that are making grants in this area, or at least have an interest in it.

Are you on your own, so to speak, or have the research directors of these agencies sat down in a closed-session conference and tried to draw broad outlines of how we might best utilize the means which are made available by the Congress in this whole area of research on the aging?

Now surely this would involve the Department of Agriculture. It might very well go into the Atomic Energy Commission as regards some of your radiation studies.

It might very well go into several of the institutes of NIH, especially its Center for Aging Research, and into the Veterans' Administration.

VETERANS' ADMINISTRATION INTEREST IN AGING

On this point, a little later on this morning, we are going to hear from the Veterans' Administration representative.

Let me point out that no single agency of the U.S. Government will be or is meeting the medical needs of a larger group of senior citizens than the Veterans' Administration.

The ex-servicemen of World War I and of previous conflicts have all reached the age where medical problems characteristic of advanced years become extremely significant. And in the years ahead, as the vast number of veterans who served in World War II advance to elderly ages, the VA will be faced with a still greater responsibility. It is not simply the responsibility to meet the problem of diseases of the aged, but, rather more positively, to help our veterans to enjoy the fullest of health.

I am going to ask that, as an exhibit at this point in the transcript, there be included an article which appeared in the July 13, 1960, issue of "Scope" on this subject of over 100 research projects in VA alone in the field of the aging.

The article follows:

EXHIBIT 6

ARTICLE IN "SCOPE" ON VA RESEARCH PROJECTS IN THE AGING

[July 13, 1960]

STUDY OF AGING PURSUED BY VA IN 100 PROJECTS

(By World Wide Medical News Service, Washington Bureau)

WASHINGTON, D.C.—With more than 300,000 patients 45 and over, the Veterans' Administration hospital and domiciliary care system offers perhaps the largest single source of clinical data on the medical problems of the aged.

To get the answers, VA is sponsoring nearly 100 research projects on the biological aspects of aging in the cell, the organ, and the organism; the changes that age produces in the individual; and special deteriorations usually attributed to age.

The VA also has 262 separate research projects in the field of cancer, 399 in cardiovascular disease, 242 in nonmalignant diseases of the genitourinary tract, 138 of nonmalignant diseases of the genitourinary system, 87 of skeletal and joint abnormalities, and 44 in diabetes. All are directly or indirectly related to aging.

Some examples of the research being conducted on aging in VA hospitals:

Effects of anticoagulants over a long period on body fat are being studied at 11 hospitals.

Intraocular pressures of all individuals over 45 who are patients at the VA outpatient clinic in Brooklyn are being studied as part of a glaucoma research project.

Hearing, believed to decrease after 40, is being evaluated at the VA West Side Hospital in Chicago.

Ground substance and how it is affected by drugs and hormones is being studied at VA hospitals in Pittsburgh and Downey, Ill.

Effect of age on intestinal motility is being investigated at the VA hospital in New York.

A varied and extensive attempt to correlate physical and mental changes with age in individuals is underway at the VA center in Martinsburg, W. Va. The rate at which thyroid function diminishes with age has been established. Electroencephalographic changes with age and the differences in response to psychopharmacologic agents are likewise being studied there, as is the chemistry of connective tissue and its response to hormone administration.

MEDICAL SERVICES INCREASED

A strengthening of medical services for the aging and chronically ill was recently announced by VA Administrator Sumner G. Whittier. Newer steps include establishing day care centers for mental patients, improving vocational rehabilitation services, developing community home care plans for patients, and planned living programs for VA domiciliary residents.

In addition, geriatric clinics were established in VA outpatient facilities in Brooklyn, Boston, and San Francisco. Rehabilitation services are also being extended from the clinics into the homes of veterans with service-connected disabilities.

One of the problems confronting the aged veteran was pinpointed recently by Bradford Morse, Deputy VA Administrator, in a statement to the Senate Subcommittee on Aging.

"The aging veteran in our hospitals today is creating certain problems which are extremely difficult to deal with," he said. "We do not operate nursing homes. We admit a veteran with a non-service-connected disability only when he has a condition which requires definitive hospital treatment.

"When the aged veteran has reached the point in his treatment in our hospitals where he needs nothing more than nursing care, he is discharged to his own home. But those whose relatives can't or won't care for them become a problem * * * We cannot discharge them from the hospital unless they have a place to go and someone to help them."

INITIATIVE FOR CALLING MEETING

Senator HUMPHREY. So, many agencies are interested in the problem of the aging.

Is there any way that you can call a meeting? Who runs the show? I mean who is Mr. Big in this research effort? You can't have the President calling all these meetings. Just how do we do this?

Dr. SHANNON. Sir, I could comment briefly how it is done now with deficiencies. There is coordination. It is not usually with people on my level or Dr. Dunham's level.

But permanent coordination of this type comes from liaison representation with the groups that are the action groups in the area.

For instance, as regards the councils, which are the program developers of NIH in association with the staffs of the Institutes, at their meetings they will have such broad presentations. And at such meetings we will have continuity of representation from the various Federal agencies that have impact in our fields: The National Science Foundation, Department of Defense—usually, more than Department of Defense, the Army and Navy with separate representation—the Veterans' Administration. I think these would be the main ones concerned.

CONTACT WITH DEPARTMENT OF AGRICULTURE

We have not, I must confess, had as much collaborative activity with the Department of Agriculture as I suspect we should have. They are not part of our normal liaison. We call them in on special problems that we know they have an interest in.

I would say my counterparts in the other agencies also have this type of liaison because we make available to them, Senator, liaison members to sit in on their deliberations. So there is a continuous cross-exchange and cross-fertilization in interagency working relationships.

The crux, or the main thrust, of your question, I don't think I have answered.

I will attempt to do this now. There is not a mechanism that normally is thrown into operation that would result in systematic review of broad problems that are highlighted as being particularly important at any given point of time.

The cooperation, collaboration, the interchange of information, become part of the routine way of doing business.

Now, I would not in any way want to touch that.

Senator HUMPHREY. No; I would not either.

Dr. SHANNON. The question is whether over and above that there should be one.

Senator HUMPHREY. That is the point, Doctor. I am not drawing any conclusion. We are just tossing this out for general discussion. I think we are aware of this type of coordination.

Senator Mundt?

FEDERAL COUNCIL ON SCIENCE AND TECHNOLOGY

Senator MUNDT. You did not answer one question which Senator Humphrey asked you which intrigued me, and I think you possibly lost it in the question.

He said under your scheme of things, whose responsibility is it to call these meetings? Who is really in charge in determining whether a conference should be held and who do you look to, to say this is the time, now is the place, and this is the subject on which we should meet?

Dr. SHANNON. Yes, sir, I will try to answer that question more directly.

There is a mechanism in Government whereby this should be done. I don't think it has worked effectively up to this time because it is too young. The responsibility for highlighting broad national needs and calling them to the attention of the constituent agencies that have an interest is the responsibility of the Federal Council on Science and Technology.

This is a recently formed council that consists of the Assistant Secretaries of all of the agencies with operational programs in fields of research and development.

Now, unfortunately, since 95 percent of research and development in this country is in the field of the physical sciences and only 5 percent in the field of biology and medicine, the main things that come before this council—I will mention three of which there has been serious consideration over the past years—are studies in the atmospheric sciences, oceanography, and materials research.

But this council would be the normal place where this question should arise.

Now, responsible to that council is something that is called the standing committee. This is made up of permanent employees of Government, by and large the program directors of all the departments that have broad programs of research and development, who sit together once a month.

I sit on that committee, Dr. Astin for Commerce, and people of that sort.

These are the two bodies that are formally constituted to consider problems such as you suggest, but I must confess their preoccupation

with the practical running of the Federal plant is the thing that preoccupies most of their time as opposed——

WHERE DOES RESPONSIBILITY RESIDE?

Senator MUNDT. Is there no particular fixed responsibility for calling conferences dealing with the biomedical aspects?

I can see how, if it deals with all research and development, this is a big field for the Government and there are many other factors besides the health of the citizens. I think Senator Humphrey's question was directed to this particular aspect:

Whose responsibility is it under your scheme of things to decide a conference should be held or should not be held on some new projected research dealing with the health of the human being?

RESPONSIBILITY OF NIH

Dr. SHANNON. This responsibility in certain areas has been firmly fixed by the Congress in the establishment of the categorical institutes of the National Institutes of Health.

Each of these institutes is assigned the broad responsibilities to develop research and training programs in areas that are relevant to the category as defined by the Congress.

The director of that institute is asked to assume for the Public Health Service, which has accepted this responsibility, the responsibility of serving as the focal point in the Public Health Service, and, in fact, the focal point in Government, for seeing that the broad areas of research that are relevant to the disease problems contained within this category are furthered.

It is his responsibility specifically set by the Congress, through the Surgeon General, to him.

I think you will find comparable legislative responsibility fixing, as best the Congress can define these broad areas, areas in the National Science Foundation, areas in AEC. But I think that the problem, or the main thrust of Senator Humphrey's problem, that I can't answer adequately is that there are gray areas that are not really the normal or exclusive responsibility of one agency or the normal or exclusive responsibility of the other.

Now, Senator Mundt, it has been my experience that, in general, these are handled very well because one agency in discussion with the other says, "We will accept priority responsibility for carrying the ball in this area," but in this situation, as Senator Humphrey has indicated, occasionally somebody does not pick up the ball.

The problem of aging, I think, has been accepted by NIH as a primary responsibility.

I think that, if anything, sir, this area has been overcoordinated in terms of the honest approaches of a research nature to many problems in the field.

This is a very popular subject.

Senator HUMPHREY. May I interrupt right there?

Dr. SHANNON. Yes, sir.

IS THERE DANGER OF OVERSUPPORT?

Senator HUMPHREY. This is one of the concerns that I have. I have a high regard for scientists and I stand in awe of their capabilities, but I am afraid they are humans, too.

When something becomes a fad, if we don't watch out, the resources that are made available become excessive and fall right into an obsolete, well-grooved channel.

Dr. SHANNON. Yes, sir.

Senator HUMPHREY. And that is the reason that I feel that you need kind of a clear, objective look, even if you sometimes have to run against the tide of the magazine articles and the publicists that are telling us all we need to do is spend a little more money in this area and we have got this one licked.

LETTER FROM DR. GEORGE KISTIAKOWSKY

Senator Mundt and Dr. Shannon, I think that a letter sent from Dr. Kistiakowsky, the President's science adviser, to us, on July 27, will be of some help to us.

I directed a communication to him on June 17, requesting information on the interagency coordination of Federal health activities, and he was very candid and helpful in his reply.

I will read only part of it. He refers to the pertinent Executive order, of which we have a copy. All of this will be made a part of our testimony here.

He says, speaking now of the Federal Council for Science and Technology:

As you will note from the Executive order, the Federal Council is charged with recommending policies on problems and developments in the fields of science and technology of an interagency character or concerning the overall advancement of the Nation's science and technology.

It is to this that you referred, Dr. Shannon?

Dr. SHANNON. Yes.

Senator HUMPHREY. Then he says:

It is thus in a position to serve as an effective channel of coordination on policy matters, although it has no responsibilities for the operation of Federal programs in science and technology including health. Since these latter responsibilities are assigned by statute to a number of agencies and are financed by appropriated funds, the annual budget and appropriation process provides for coordination both within the executive branch and in the Congress.

COORDINATION ON INTERNATIONAL HEALTH

As far as I am aware, the Interdepartmental Committee on International Health Policy is the only interagency organization specifically concerned with coordination in the international health field. It serves as a regular mechanism for advising the Secretary of State as to the objectives and programs of Government agencies in this field. While there is no direct relationship between the Interdepartmental Committee and the Federal Council, the Council's representative from the Department of Health, Education, and Welfare regularly attends the meetings of the Interdepartmenal Committee, and thus a means exists for the exchange of information of mutual interest. * * * the Federal Council does not itself have a panel on health. However, the Council has organized a Com-

mittee on International Science which is concerned broadly with Federal scientific activities overseas.

The full text of Dr. Kistiakowsky's letter together with the text of the Executive order which set up the Federal Council for Science and Technology and which he appended to his letter will now appear in the record.

EXHIBIT 7

LETTER OF JULY 27, 1960, FROM FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY REGARDING INTERAGENCY GROUPS ON SCIENTIFIC POLICY

THE WHITE HOUSE,
Washington, July 27, 1960.

DEAR SENATOR HUMPHREY: With regard to your letter of June 17 requesting information on interagency coordination for Federal health activities, I am enclosing a copy of Executive Order 10807 which sets forth the duties and membership of the Federal Council for Science and Technology. As you will note from the Executive order, the Federal Council is charged with recommending policies on problems and developments in the fields of science and technology of an interagency character or concerning the overall advancement of the Nation's science and technology. It is thus in a position to serve as an effective channel of coordination on policy matters, although it has no responsibilities for the operation of Federal programs in science and technology including health. Since these latter responsibilities are assigned by statute to a number of agencies and are financed by appropriated funds, the annual budget and appropriation process provides for coordination both within the executive branch and in the Congress.

As far as I am aware, the Interdepartmental Committee on International Health Policy is the only interagency organization specifically concerned with coordination in the international health field. It serves as a regular mechanism for advising the Secretary of State as to the objectives and programs of Government agencies in this field. While there is no direct relationship between the Interdepartmental Committee and the Federal Council, the Council's representative from the Department of Health, Education, and Welfare regularly attends the meetings of the Interdepartmental Committee, and thus a means exists for the exchange of information of mutual interest. * * * the Federal Council does not itself have a panel on health. However, the Council has organized a Committee on International Science which is concerned broadly with Federal scientific activities overseas.

The President's Science Advisory Committee likewise has no direct relationship with the Interdepartmental Committee on International Health Policy, but it also has a panel on science and foreign affairs which is broadly concerned with the ways in which science and technology enter into foreign relations. More recently, the Science Advisory Committee has organized a panel to study problems of research in the life sciences, and this panel will be concerned with research in the medical sciences as part of this task.

Since I serve as Chairman of both the President's Science Advisory Committee and the Federal Council for Science and Technology, there is a direct relationship and channel of communication between these two advisory groups in the Executive Office of the President.

As you mentioned in your letter, there are various committees of the National Academy of Sciences and National Research Council which are advisory to Federal agencies on health problems. Most of these committees are organized under the Division of Medical Sciences of the National Research Council, and their activities are described in the Annual Report of the National Academy of Sciences and National Research Council.

I hope these comments will be helpful to you and the subcommittee.

Sincerely,

G. B. KISTIAKOWSKY.

[Reprinted from the Federal Register of Tuesday, March 17, 1959]

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

TITLE 3—THE PRESIDENT

EXECUTIVE ORDER 10807

WHEREAS science and technology are essential resources for the security and welfare of the United States; and

WHEREAS Federal programs in science and technology will advance our security, health, and economic welfare and the quality of education in the United States; and

WHEREAS closer cooperation among Federal agencies will facilitate the resolution of common problems in science and technology, promote a greater measure of coordination, and otherwise improve the planning and management of Federal programs in these fields:

NOW, THEREFORE, by virtue of the authority vested in me as President of the United States, it is hereby ordered as follows:

SECTION 1. *Establishment of Council.* (a) There is hereby established the Federal Council for Science and Technology (hereinafter referred to as the Council).

(b) The Council shall be composed of the following-designated members: (1) the Special Assistant to the President for Science and Technology, (2) one representative of each of the following-named departments, who shall be designated by the Secretary of the Department concerned and shall be an official of the Department of policy rank: the Departments of Defense, the Interior, Agriculture, Commerce, and Health, Education, and Welfare, (3) the Director of the National Science Foundation, (4) the Administrator of the National Aeronautics and Space Administration, and (5) a representative of the Atomic Energy Commission, who shall be the Chairman of the Commission or another member of the Commission designated by the Chairman. A representative of the Secretary of State designated by the Secretary and a representative of the Director of the Bureau of the Budget designated by the Director may attend meetings of the Council as observers.

(c) The Chairman of the Council (hereinafter referred to as the Chairman) shall be designated by the President from time to time from among the members thereof. The Chairman may make provision for another member of the Council, with the consent of such member, to act temporarily as Chairman.

(d) The Chairman (1) may request the head of any Federal agency not named in section 2(b) of this order to designate a representative to participate in meetings or parts of meetings of the Council concerned with matters of substantial interest to the agency, and (2) may invite other persons to attend meetings of the Council.

(e) The Council shall meet at the call of the Chairman.

SEC. 2. *Functions of Council.* (a) The Council shall consider problems and developments in the fields of science and technology and related activities affecting more than one Federal agency or concerning the over-all advancement of the Nation's science and technology, and shall recommend policies and other measures (1) to provide more effective planning and administration of Federal scientific and technological programs, (2) to identify research needs including areas of research requiring additional emphasis, (3) to achieve more effective utilization of the scientific and technological resources and facilities of Federal agencies, including the elimination of unnecessary duplication, and (4) to further international cooperation in science and technology. In developing such policies and measures the Council, after consulting, when considered appropriate by the Chairman, the National Academy of Sciences, the President's Science Advisory Committee, and other organizations, shall consider (i) the effects of Federal research and development policies and programs on non-Federal programs and institutions, (ii) long-range program plans designed to meet the scientific and technological needs of the Federal Government, including manpower and capital requirements, and (iii) the effects of non-Federal programs

in science and technology upon Federal research and development policies and programs.

(b) The Council shall consider and recommend measures for the effective implementation of Federal policies concerning the administration and conduct of Federal programs in science and technology.

(c) The Council shall perform such other related duties as shall be assigned, consonant with law, by the President or by the Chairman.

(d) The Chairman shall, from time to time, submit to the President such of the Council's recommendations or reports as require the attention of the President by reason of their importance or character.

SEC. 3. *Agency assistance to Council.* (a) For the purpose of effectuating this order, each Federal agency represented on the Council shall furnish necessary assistance to the Council in consonance with section 214 of the act of May 3, 1945, 59 Stat. 134 (31 U.S.C. 691). Such assistance may include (1) detailing employees to the Council to perform such functions, consistent with the purposes of this order, as the Chairman may assign to them, and (2) undertaking, upon request of the Chairman, such special studies for the Council as come within the functions herein assigned to the Council.

(b) Upon request of the Chairman, the heads of Federal agencies shall, so far as practicable, provide the Council with information and reports relating to the scientific and technological activities of the respective agencies.

SEC. 4. *Standing committees and panels.* For the purpose of conducting studies and making reports as directed by the Chairman, standing committees and panels of the Council may be established in consonance with the provisions of section 214 of the act of May 3, 1945, 59 Stat. 134 (31 U.S.C. 691). At least one such standing committee shall be composed of scientist-administrators representing Federal agencies, shall provide a forum of consideration of common administrative policies and procedures relating to Federal research and development activities and for formulation of recommendations thereon, and shall perform such other related functions as may be assigned to it by the Chairman of the Council.

SEC. 5. *Security procedures.* The Chairman shall establish procedures to insure the security of classified information used by or in the custody of the Council or employees under its jurisdiction.

SEC. 6. *Other orders; construction of orders.* (a) Executive Order No. 9912 of December 24, 1947, entitled "Establishing the Interdepartmental Committee on Scientific Research and Development," is hereby revoked.

(b) Executive Order No. 10521 of March 17, 1954, entitled "Administration of Scientific Research by Agencies of the Federal Government," is hereby amended:

(1) By substituting for section 1 thereof the following:

"SECTION 1. The National Science Foundation (hereinafter referred to as the Foundation) shall from time to time recommend to the President policies for the promotion and support of basic research and education in the sciences, including policies with respect to furnishing guidance toward defining the responsibilities of the Federal Government in the conduct and support of basic scientific research."

(2) By inserting before the words "scientific research programs and activities" in section 3 thereof the word "basic."

(3) (i) By adding the word "and" at the end of paragraph (a) of section 8 thereof, (ii) by deleting the semicolon and the word "and" at the end of paragraph (b) of section 8 and inserting in lieu thereof a period, and (iii) by revoking paragraph (c) of section 8.

(4) By adding at the end of the order a new section 10 reading as follows:

"SEC. 10. The National Science Foundation shall provide leadership in the effective coordination of the scientific information activities of the Federal Government with a view to improving the availability and dissemination of scientific information. Federal agencies shall cooperate with and assist the National Science Foundation in the performance of this function, to the extent permitted by law."

(c) The provisions of Executive Order No. 10521, as hereby amended, shall not limit the functions of the Council under this order. The provisions of this order shall not limit the functions of any Federal agency or officer under Executive Order No. 10521, as hereby amended.

(d) The Council shall be advisory to the President and to the heads of Federal agencies represented on the Council; accordingly, this order shall not be construed as subjecting any agency, officer, or function to control by the Council.

DWIGHT D. EISENHOWER.

THE WHITE HOUSE, *March 13, 1959.*

INITIATIVE BY AN AGENCY OR DIVISION HEAD

Senator HUMPHREY. So what you get at here, what you finally end up with, is that while the Federal Council for Science and Technology under Executive order has broad responsibilities for policy—I would not say direction, but coordination—and tries to outline the areas that we ought to proceed in, it has, as yet, not established a panel on health or the life sciences. Thus, there is sort of a void as regards the top level of responsible coordination.

The coordination instead comes out of the initiative of a man like yourself, Dr. Shannon, or some of your distinguished associates who are vitally concerned with a particular area; as you said, for example, problems of the aging, where NIH has one of the main responsibilities.

I suppose that just out of your sheer professional knowledge and leadership ability, you take command, so to speak, and bring people together with you to work on these research problems.

Now, this is a very fortunate thing as long as we have Dr. Shannon.

Dr. SHANNON. Thank you, sir.

Senator HUMPHREY. And I say this most respectfully, because I am one of your admirers. The point is that sometimes we may have a very competent scientist and a very competent person in the field of technology or science, but he may not get himself around to where he feels that he ought to be a coordinator.

I don't think we can rely on——

Senator MUNDT. At the end of that first paragraph, did you mean "Congress" or "coordination"?

PROBLEM CONFRONTING CONGRESS

Senator HUMPHREY. Coordination.

Senator MUNDT. I happen to have served for some time on the subcommittee that handles the funds for these agencies and still serve on the full committee, and I know that we are just not set up at all to do this job, so we have got to find somebody else other than the Appropriation Committees of the Congress.

We, I am sure, would be guilty of what you said, Dr. Shannon; namely, a situation where a bad decision probably is worse than no decision at all.

We simply lack the competency to do the coordinating. We might put in some riders, suggestions, and mandates that there be sort of a National Security Council on Health with you in charge of it and these eight agency associates all members of it, that you have to meet at high noon every alternate Thursday, but we would not be able to work out the details mentioned in that paragraph.

Dr. SHANNON. Senator Mundt, there is one thing I omitted from this panorama of what affects the decision-making process, and I was just reminded by one of my colleagues.

SCIENCE ADVISORY COMMITTEE

Dr. Kistiakowsky's committee, the Science Advisory Committee, does have a panel on the life sciences. This is headed by George Beadle of Cal Tech. Their activities to date have encompassed the serious study of agriculture's research program.

I have a letter, or, rather, the Secretary had a letter from Dr. Kistiakowsky about a week or 10 days ago that indicated they wished to come to the National Institutes of Health for some preliminary discussions, the nature of which I don't know.

This is by way of a preliminary survey. So I think that there is an appreciation of the problem we are discussing.

Senator HUMPHREY. That is in the Science Advisory Committee?

Dr. SHANNON. Yes, sir, purely an advisory committee.

Senator HUMPHREY. It is not the Federal Council for Science and Technology?

Dr. SHANNON. No, sir.

Senator HUMPHREY. Which is really the mechanism that the President set up under Executive order to effectuate better programing and emphasis and coordination in all of the fields of science and technology?

LIFE SCIENCES PROPORTION VIS-A-VIS PHYSICAL SCIENCES

Dr. SHANNON. Yes, sir.

I think, as I have pointed out, one of the problems here, and the reason why the life sciences have, as yet, received no serious attention, but I am sure they will, is the dollar value of these programs is 5 percent of the total dollar value of the Nation's investment in research and development, and I think the sheer pressure of the need for decisions in the physical sciences that relate to such problems as defense, international policies relating to our economic relations with other countries, have forced the things to the forefront that have the largest dollar value.

Senator Humphrey, I am a bit prejudiced. I think the importance of this little 5 percent is much more than is indicated by its dollar relationship to the total sum our Nation spends. I would be the last one to say that serious attention to problems of health on the highest possible level would not bear substantial fruit.

LIFE SCIENCES MAY REMAIN SMALL PROPORTION

Senator MUNDT. Isn't it true, Dr. Shannon, if we apply that yardstick, we are never going to have the kind of coordination which we would all like to have?

Dr. SHANNON. That is right.

Senator MUNDT. In this field?

Dr. SHANNON. Yes, sir.

Senator MUNDT. Because you are always going to be a small percentage of the total costs of research and development in this great big country of ours?

Dr. SHANNON. I think we should be a small percentage.

Senator MUNDT. I am looking at the figure now, not from the standpoint of its percentages, but from the standpoint of the National Institutes of Health having spent $1,615 million since 1938. This is big money.

Dr. SHANNON. Yes, sir.

Senator MUNDT. Even in our country, and it would seem to me that we should give some consideration to establishing the maximum amount and the optimum amount of coordination between your nine

agencies on these problems. You might get even better results from the almost $2 billion that we have appropriated in the face of what appears to be a bit of a lack of coordination, as we look at these myriads of projects and this multiplication of operations.

Dr. SHANNON. Well, sir, I would agree. I would emphasize, though, on the working level, I think there is exceptionally fine coordination. There is not, on the other hand, the type of coordination you are seeking on a very high policy level, and I would be the first to admit that.

Senator HUMPHREY. I will ask that the record show a table listing year-by-year appropriations to NIH since 1938, aggregating the figure Senator Mundt has mentioned. The table was furnished at our request by the Institutes.

EXHIBIT 8

Obligational history, NIH appropriations, fiscal years 1938–59

[Rounded in millions]

1938	$0.5	1946	$3.0	1954	$70.0
1939	.5	1947	8.0	1955	81.0
1940	1.0	1948	28.0	1956	98.0
1941	1.0	1949	38.0	1957	170.0
1942	1.0	1950	52.0	1958	210.0
1943	1.0	1951	60.0	1959	285.0
1944	3.0	1952	51.0	1960 estimated	395.0
1945	3.0	1953	55.0		

AEC PREDOMINANT IN RADIATION RESEARCH

Senator HUMPHREY. This table underlines the fact that the National Institutes of Health are and have been the principal medical research arm of the Federal Government.

However, the point that we cannot stress too often is that in many fields NIH's work parallels or overlaps with similar work by other Federal agencies. Even where some subjects appear initially to be different, it is next to impossible to tell where scientific research will lead. For example, no one can predict where genetics research is going to lead—in terms of human disease, animal and plant diseases.

In any event, in some areas, NIH is not the principal Federal research arm. For example, in radiation research in the life sciences, we find that the Atomic Energy Commission has 1,027 projects underway, costing $47.4 million, while the whole Department of Health, Education, and Welfare has 392 projects underway costing $6.2 million.

NIH'S PREDOMINANT ROLE DOES NOT LESSEN COORDINATION NEED

The fact, however, that in almost all other fields, other agencies do not spend as much as NIH does not in the slightest lessen the need for interagency coordination. A million dollars spent by another Federal agency is no less significant to the American taxpayer merely because NIH may be spending many times that sum in somewhat the same field.

The fundamental fact is that there are common subjects of interests among the agencies and that the flow of information is essential whether the agencies are disproportionate in size of total expenditures or not.

61916—60——4

CHART ON NIH RESEARCH PROJECTS

At this point in the record there will appear a comprehensive chart (exhibit 9) which will summarize for NIH as a whole and for each of the institutes the number and dollar volume of intramural and extramural research projects in the 1960 fiscal year. Information for the chart is now being compiled by NIH at our request. The graphic work will be performed by the institutes.

The subcommittee could, of course, print this information in a separate series of tables rather than in one large chart. However, we believe that in this instance, in view of our emphasis on coordination, a large scale chart is far preferable. Through this large chart, the reader can, in a matter of moments, see the vast scope of NIH in its entirety. The reader, too, can quickly discern interrelationships in the work of the various institutes which might otherwise be less obvious.

For a total view of Government-wide biochemical research, the reader can consult this chart in conjunction with the chart for other agencies (exhibit 69).

NUMEROUS NIH RESPONSES TO INQUIRIES

Senator HUMPHREY. Before we conclude with this phase of the record bearing directly upon the National Institutes of Health, I should like to reiterate that during the past several months Dr. Shannon and his associates have provided the subcommittee at our request with a wide variety of very valuable information. We are very grateful.

We know that the fulfillment of our inquiries has taken a great deal of time on the part of the National Institutes of Health staff, particularly in the Office of Program Planning. Before conveying any of our requests the project director and I have always carefully considered the purposes which the compilation of particular types of information might genuinely serve. Only after we have been satisfied that the development of particular data would serve a very useful and indeed an essential purpose, have we sent a request.

Several of the responses by Dr. Shannon and his associates will be reprinted in whole or in part, not only within and at the conclusion of this hearing transcript, but in a series of committee prints which we have been developing as part of our original authorizing resolution, Senate Resolution 347, 85th Congress, on International Health.

EXCERPTING OF INQUIRIES AND RESPONSES

In some instances, a single outgoing letter to NIH from the subcommittee has contained numerous requests on various subjects.

In order to isolate and classify topics within the various responses, we have excerpted from the outgoing letters of request, and from the incoming responses, each specialized subject. In each such instance, we have carefully indicated that a letter has been excerpted. Only information not relevant under a particular heading is deleted in any instance; all other information is included.

All or virtually all of the data which may be temporarily deleted will be cited within this or future publications under other appropriate headings.

EXHIBIT

CHART OUTLINING INTRAMURAL AND EX
INSTITUTES OF

RESEARCH PROJECTS—EXTRAMU
SUPPORTED BY THE NATIONAL
FISCAL YEAR

INTRODUCTORY NOTE: This chart is designed to indicate the number, scope, and diversity of research projects conducted or supported by the National Institutes of Health. Information for the chart was developed by the Institutes in August 1960 at the invitation of the Senate Committee on Government Operations, as part of a Study of Inter-Agency Coordination of Medical Research by the Subcommittee on Reorganization and International Organizations. Major decisions as to the nature of the contents and format of the chart were made by the Senate Committee.

It is hoped that the presentation of this much information in one large scale chart will help to bring out interrelationships in a clearer manner than would be possible if data were dispersed over several pages.

NATIONAL CANCER INSTITUTE

	Totals	Number	Dollar Volume
	Extramural	1,848	$56,174,566
	Intramural	324	14,476,139
		2,172	$70,650,705
EXTRAMURAL			
A. Research grants			
Carcinogenesis		287	$5,845,136
Cancer development		300	5,764,367
Diagnosis		93	1,705,516
Epidemiology		39	564,257
Therapy		535	12,171,775
Normal tissues		366	6,935,990
Other		61	1,153,613
	Total grants	1,681	$34,140,654
B. Research contracts			
Diagnosis		21	$901,027
Therapy		146	21,132,885
	Total contracts	167	$22,033,912
INTRAMURAL			
Carcinogenesis		49	$1,868,812
The nature of cancer — metabolism and endocrinal		39	2,322,627
Cancer in the host — biological factors including genetics		12	605,154
Studies on the nature of cancer cells and tissues		50	2,216,128
Cancer biochemistry and biophysics		16	830,774
Diagnostic research		27	2,228,196
Epidemiology		44	1,042,323
Chemotherapy		27	2,501,940
Radiation		41	608,531
Other		19	251,654

NATIONAL INSTITUTE OF NEUROLOGICAL DISEASES AND BLINDNESS

	Totals	Number	Dollar Volume
	Extramural	1,075	$23,093,865
	Intramural	183	5,989,000
		1,258	$29,082,865
EXTRAMURAL – RESEARCH GRANTS			
A. Neurological disorders			
Chronic, of childhood and adolescence		104	$6,329,029
Cerebral vascular		69	1,337,385
Chronic, of aging		92	1,723,390
Epilepsy and related paroxysmal		77	1,355,083
Sclerosing		60	1,255,065
Muscular and neuromuscular		75	1,303,597
Other, including general		209	3,054,928
B. Sensory and perceptual disorders			
Vision		236	4,015,000
Speech, sound, higher cerebral function		22	351,820
Other senses		51	678,767
C. Noncategorical		4	76,264
INTRAMURAL			
A. Neurological disorders			

NATIONAL HEART

	Totals
	Extramural
	Intramural
EXTRAMURAL — RESEARCH GRANTS	
A. Disease specific	
Arteriosclerosis	
Hypertension	
Congenital heart disease	
Rheumatic heart disease	
Rheumatic fever	
Aging	
Heart failure	
B. Organ specific	
Heart and blood vessels	
Blood	
Lung	
Kidney	
Liver	
Endocrine glands	
C. Other organs, tissues, cells, and basic mechanisms	
INTRAMURAL	
A. Disease specific	
Arteriosclerosis	
Hypertension	
Congenital heart disease	
Rheumatic heart disease	
Rheumatic fever	
Aging	
Heart failure	
B. Organ specific	
Heart and blood vessels	
Blood	
Lung	
Kidney	
Endocrine glands	
C. Other organs, tissues, cells, and basic mechanisms	

NATIONAL INSTITUTE OF ALLERGY

	Totals
	Extramural
	Intramural
EXTRAMURAL — RESEARCH GRANTS	
Allergy	
Antibiotics	
Arthropods	
Bacteriology	
Biochemistry	
Chemotherapy	
Detection	
Epidemiology	
Genetics	
Immunology	
Mycology	
Parasitology	
Physiology	

EXHIBIT 9

L AND EXTRAMURAL RESEARCH BY NATIONAL
ITUTES OF HEALTH

XTRAMURAL AND INTRAMURAL–
TIONAL INSTITUTES OF HEALTH
AL YEAR 1960

Totals	Number*	Dollar Volume
NIH Extramural Research Projects:	10,564	$209,661,317
NIH Intramural Research Projects:	1,501	51,024,453
Grand Total:	12,065	$260,685,770

L HEART INSTITUTE

Totals	Number	Dollar Volume
xtramural	1,868	$33,968,000
tramural	339	7,293,618
	2,207	$41,261,618
ANTS		
	557	$11,424,000
	168	3,312,000
	139	2,429,000
	62	988,000
	37	842,000
	51	1,335,000
	191	2,989,000
	278	4,450,000
	141	2,636,000
	104	1,437,000
	73	1,016,000
	20	245,000
	1	6,000
	46	859,000
	50	$1,245,609
	13	475,110
	3	139,728
	1	16,000
	9	169,506
	31	505,473
	7	95,726
	63	1,464,576
	3	71,285
	3	38,883
	11	226,815
	12	473,071
	133	2,371,836

ALLERGY AND INFECTIOUS DISEASES

Totals	Number	Dollar Volume
Extramural	1,440	$21,245,792
ntramural	172	6,510,299
	1,612	$27,756,091
RANTS		
	135	$2,217,209
	50	553,563
	97	900,445
	379	5,694,276
	70	1,069,822
	9	120,018
	2	22,827
	3	87,487
	22	302,632
	119	1,884,978
	85	881,388
	187	1,980,525
	9	139,604

NATIONAL INSTITUTE OF ARTHRITIS AND METABOLIC DISEASES

Totals	Number	Dollar Volume
Extramural	1,910	$30,738,211
Intramural	152	7,360,645
	2,062	$38,098,856
EXTRAMURAL – RESEARCH GRANTS		
Arthritis	254	$4,120,313
Diabetes	383	6,709,425
Gastroenterology	270	4,019,012
Cystic fibrosis	28	485,159
Nutrition	68	1,228,321
Hematology	76	1,382,781
Immunology	16	251,834
Physical biology	137	2,485,390
Radiation	48	633,894
Skin	12	179,197
Miscellaneous	39	576,859
Metabolism of substances	340	4,925,799
Metabolism by or in organs	189	2,879,665
Miscellaneous aspects of metabolism	50	860,562
INTRAMURAL		
Nutrition and endocrinology	18	$983,192
Biochemistry and metabolism	16	793,936
Chemistry	37	1,145,194
Pathology and histochemistry	17	693,675
Pharmacology and toxicology	15	674,764
Physical biology	20	1,600,021
Clinical investigations	29	1,469,863

NATIONAL INSTITUTE OF DENTAL RESEARCH

Totals	Number	Dollar Volume
Extramural	333	$4,476,000
Intramural	65	1,534,898
	398	$6,010,898
EXTRAMURAL — RESEARCH GRANTS		
Dental caries	42	$596,793
Periodontal disease	27	357,233
Congenital anomalies	24	320,510
Neoplasms (oral cancer)	6	105,386
Malocclusion	6	49,746
Bone and enamel	24	252,299
Calcification	12	215,682
Saliva and salivary glands	21	259,409
Growth and development	16	198,598
Dental materials	14	113,025
Dental pulp	12	177,341
Aging and methodology of gerodontia	7	70,483
Radiation and methodology of radiology	6	140,584
Other, including basic research	116	1,618,911
INTRAMURAL		
Genetics studies	6	$98,907
Epidemiological studies	8	168,509
Experimental and clinical pathology and microbiological studies	19	380,978
Germfree studies	2	87,918
Nutritional and biochemical studies of dental	5	131,877

	3	71,285
	3	38,883
	11	226,815
	12	473,071
	133	2,371,836

ALLERGY AND INFECTIOUS DISEASES

Totals	Number	Dollar Volume
Extramural	1,440	$21,245,792
Intramural	172	6,510,299
	1,612	$27,756,091
GRANTS		
	135	$2,217,209
	50	553,563
	97	900,445
	379	5,694,276
	70	1,069,822
	9	120,018
	2	22,827
	3	87,487
	22	302,632
	119	1,884,978
	85	881,388
	187	1,980,525
	9	139,604
	14	175,452
	7	107,025
	16	197,300
	236	4,911,241
	43	$1,541,930
	18	424,127
	4	434,102
	6	160,750
	17	472,170
	22	466,585
	9	199,933
	11	676,363
	17	393,490
	14	591,771
ms	5	626,773
diseases		
United States	6	522,305

INICAL CENTER

Total	Number	Dollar Volume
Intramural	22	$73,454
	1	$ 2,500
	1	7,000
	1	9,900
	1	1,500
ents	1	6,644
blood pressure	1	6,644
zation		
	1	3,850
f		
ocial		
ing	1	1,000
ion	1	400
vations on		
	1	700
planning	1	4,000
iduals to		
	1	700
ssociated with		
	1	200
henia gravis	1	66
renia	2	3,700
dy	1	6,350
hool study	1	5,000
	1	5,650
	1	5,000
renia	1	800
ia	1	1,850

NATIONAL INSTITUTE OF DENTAL RESEARCH

Totals	Number	Dollar Volume
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	398	$6,010,898
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INTRAMURAL		
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Experimental and clinical pathology and microbiological studies	19	380,978
Germfree studies	2	87,918
Nutritional and biochemical studies of dental caries and periodontal disease	5	131,877
Growth and development	3	135,540
Evaluation of investment procedures	2	65,938
Basic research	20	465,231

DIVISION OF GENERAL MEDICAL SCIENCES

Total	Number	Dollar Volume
Extramural	1,266	$22,949,656
EXTRAMURAL		
Basic biomedical sciences		
Chemical	334	$4,880,565
Physical	38	823,675
Biological	383	5,856,073
Preclinical	43	764,436
	798	$12,324,749
Clinical sciences	60	$1,422,775
Environmental health	250	4,979,719
Public health	28	1,309,632
Nursing	36	1,038,112
Miscellaneous	94	1,874,669

DIVISION OF BIOLOGICS STANDARDS

Total	Dollar Volume
Intramural	$681,000
INTRAMURAL	
Research on sterility and stability of biological products (general)	$43,000
Research on standardization of bacterial vaccines and antitoxins	95,000
Research on application of physical and chemical methods to the control of biological products	52,000
Research on strain characteristics and identification as related to control of viral and rickettsial biological products	135,000
Research on new and improved test procedures for viral and rickettsial biological products	254,000
Research on preparation, preservation, and safety testing of blood and blood products	102,000

Note: As the work of the Division is related to control activities, no significant figure can be given for the number of projects in each of the above categories.

Other	19	251,654

NATIONAL INSTITUTE OF NEUROLOGICAL DISEASES AND BLINDNESS

Totals	Number	Dollar Volume
Extramural	1,075	$23,093,865
Intramural	183	5,989,000
	1,258	$29,082,865
EXTRAMURAL – RESEARCH GRANTS		
A. Neurological disorders		
Chronic, of childhood and adolescence	104	$6,329,029
Cerebral vascular	69	1,337,385
Chronic, of aging	92	1,723,390
Epilepsy and related paroxysmal	77	1,355,083
Sclerosing	60	1,255,065
Muscular and neuromuscular	75	1,303,597
Other, including general	209	3,054,928
B. Sensory and perceptual disorders		
Vision	236	4,015,000
Speech, sound, higher cerebral function	22	351,820
Other senses	51	678,767
C. Noncategorical	4	76,264
INTRAMURAL		
A. Neurological disorders		
Chronic, of childhood and adolescence	28	$1,902,060
Cerebral vascular	1	14,155
Chronic, of aging	4	56,465
Epilepsy and related paroxysmal	23	589,857
Sclerosing	14	378,076
Muscular and neuromuscular	22	697,354
Other, including general	45	946,916
B. Sensory and perceptual disorders		
Vision	32	872,380
Hearing and equilibrium	5	146,556
Speech, sound, higher cerebral function	4	343,187
Other senses	4	36,994
C. Noncategorical	1	5,000

NATIONAL INSTITUTE OF MENTAL HEALTH

Totals	Number	Dollar Volume
Extramural	824	$17,015,227
Intramural	207	6,945,000
	1,031	$23,960,227
EXTRAMURAL — RESEARCH GRANTS		
Biochemistry of mental illness	71	$951,151
Brain mechanisms and behavior	62	1,192,767
Psychosomatic problems	57	1,128,109
Pharmacotherapy in mental illness	96	2,259,952
Addiction to alcohol and drugs	35	735,057
Diagnosis and treatment of mental illness	124	2,224,422
Basic thought processes	55	512,158
Problems of aging	22	738,460
Mental disturbances of childhood	147	3,347,320
Social factors in mental illness	57	1,133,214
Care and rehabilitation of the mentally ill	98	2,792,617
INTRAMURAL		
Biology of mental illness	92	$3,022,815
Developmental disorders	39	1,198,565
Sociology and epidemiology of mental disorders	22	410,070
Diagnosis and treatment of the mentally ill	54	2,313,550

DIVISION OF RESEARCH SERVICES

Total	Number	Dollar Volume
Intramural	37	$160,400
INTRAMURAL		
Statistical studies on cancer	3	$36,000
Instrumentation	4	15,600
Sanitary engineering	9	40,000
Veterinary medicine	20	68,500
Genetics	1	300

* Does not include projects in the Division of Biologics Standards.

Blood
Lung
Kidney
Endocrine glands
C. Other organs, tissues, cells, and basic mechanisms

NATIONAL INSTITUTE OF ALLERG

Totals
Extramural
Intramural
EXTRAMURAL — RESEARCH GRANTS
Allergy
Antibiotics
Arthropods
Bacteriology
Biochemistry
Chemotherapy
Detection
Epidemiology
Genetics
Immunology
Mycology
Parasitology
Physiology
Public health and sanitation
Rickettsiology
Spirochetes
Virology
INTRAMURAL
Infectious diseases
Biology of viruses
Cell biology
Bacterial diseases
Parasite chemotherapy
Parasitic diseases
Germfree animal research
Tropical virology
Immunology
Clinical investigation
Biophysical and biochemical phenomena in microoganisms
Ecology and epidemiology of diseases indigenous to the western United State

CLINICAL CE

Total
Intramural
INTRAMURAL
A. Clinical pathology
Cell chemistry
Clinical chemistry
Hematology
Instrumentation, ultraviolet
B. Nursing
Study of the weighing of patients
Study of the measurement of blood press
C. Social service
Impact of long-term hospitalization on the family unit
Frequency and description of situations acted upon by social workers in discharge planning
Patients' reactions to isolation
Symptom and behavior observations on a metabolic unit
Factors related to discharge planning
Emotional reactions of individuals to having eye disease
Changes in social function associated w temporal lobectomy
Social implications of myasthenia gravis
Family relations in schizophrenia
Biosocial growth: couple study
Biosocial growth: nursery school study
College field study
College breakdown study
Biological study of schizophrenia
Family study of schizophrenia

EXHIBIT

CHART OUTLINING INTRAMURAL AND EX
INSTITUTES OF

RESEARCH PROJECTS—EXTRAMU
SUPPORTED BY THE NATIONAL
FISCAL YEAR

INTRODUCTORY NOTE: This chart is designed to indicate the number, scope, and diversity of research projects conducted or supported by the National Institutes of Health. Information for the chart was developed by the Institutes in August 1960 at the invitation of the Senate Committee on Government Operations, as part of a Study of Inter-Agency Coordination of Medical Research by the Subcommittee on Reorganization and International Organizations. Major decisions as to the nature of the contents and format of the chart were made by the Senate Committee.

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Chemotherapy	27	2,501,940
Radiation	41	608,531
Other	19	251,654

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Totals	Number	Dollar Volume
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Muscular and neuromuscular	75	1,303,597
Other, including general	209	3,054,928
B. Sensory and perceptual disorders		
Vision	236	4,015,000
Speech, sound, higher cerebral function	22	351,820
Other senses	51	678,767
C. Noncategorical	4	76,264
INTRAMURAL		
A. Neurological disorders		
Chronic, of childhood and adolescence	28	$1,902,060
Cerebral vascular	1	14,155

NATIONAL HEART

Totals
Extramural
Intramural
EXTRAMURAL — RESEARCH GRANTS
A. Disease specific
Arteriosclerosis
Hypertension
Congenital heart disease
Rheumatic heart disease
Rheumatic fever
Aging
Heart failure
B. Organ specific
Heart and blood vessels
Blood
Lung
Kidney
Liver
Endocrine glands
C. Other organs, tissues, cells, and basic mechanisms
INTRAMURAL
A. Disease specific
Arteriosclerosis
Hypertension
Congenital heart disease
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C. Other organs, tissues, cells, and basic mechanisms

NATIONAL INSTITUTE OF ALLERGY

Totals
Extramural
Intramural
EXTRAMURAL — RESEARCH GRANTS
Allergy
Antibiotics
Arthropods
Bacteriology
Biochemistry
Chemotherapy
Detection
Epidemiology
Genetics
Immunology
Mycology
Parasitology
Physiology
Public health and sanitation
Rickettsiology

EXHIBIT 9

AL AND EXTRAMURAL RESEARCH BY NATIONAL
TITUTES OF HEALTH

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ATIONAL INSTITUTES OF HEALTH
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	2	65,938

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Vision	32	872,380
Hearing and equilibrium	5	146,556
Speech, sound, higher cerebral function	4	343,187
Other senses	4	36,994
C. Noncategorical	1	5,000

NATIONAL INSTITUTE OF MENTAL HEALTH

Totals	Number	Dollar Volume
Extramural	824	$17,015,227
Intramural	207	6,945,000
	1,031	$23,960,227
EXTRAMURAL—RESEARCH GRANTS		
Biochemistry of mental illness	71	$951,151
Brain mechanisms and behavior	62	1,192,767
Psychosomatic problems	57	1,128,109
Pharmacotherapy in mental illness	96	2,259,952
Addiction to alcohol and drugs	35	735,057
Diagnosis and treatment of mental illness	124	2,224,422
Basic thought processes	55	512,158
Problems of aging	22	738,460
Mental disturbances of childhood	147	3,347,320
Social factors in mental illness	57	1,133,214
Care and rehabilitation of the mentally ill	98	2,792,617
INTRAMURAL		
Biology of mental illness	92	$3,022,815
Developmental disorders	39	1,198,565
Sociology and epidemiology of mental disorders	22	410,070
Diagnosis and treatment of the mentally ill	54	2,313,550

DIVISION OF RESEARCH SERVICES

Total	Number	Dollar Volume
Intramural	37	$160,400
INTRAMURAL		
Statistical studies on cancer	3	$36,000
Instrumentation	4	15,600
Sanitary engineering	9	40,000
Veterinary medicine	20	68,500
Genetics	1	300

* Does not include projects in the Division of Biologics Standards.

Lung
Kidney
Endocrine glands
C. Other organs, tissues, cells, and basic mechanisms

NATIONAL INSTITUTE OF ALLER

Totals
Extramura
Intramura
EXTRAMURAL — RESEARCH GRANTS
Allergy
Antibiotics
Arthropods
Bacteriology
Biochemistry
Chemotherapy
Detection
Epidemiology
Genetics
Immunology
Mycology
Parasitology
Physiology
Public health and sanitation
Rickettsiology
Spirochetes
Virology
INTRAMURAL
Infectious diseases
Biology of viruses
Cell biology
Bacterial diseases
Parasite chemotherapy
Parasitic diseases
Germfree animal research
Tropical virology
Immunology
Clinical investigation
Biophysical and biochemical phenomena in microogranisms
Ecology and epidemiology of diseases indigenous to the western United Stat

CLINICAL C

Total
Intramural
INTRAMURAL
A. Clinical pathology
Cell chemistry
Clinical chemistry
Hematology
Instrumentation, ultraviolet
B. Nursing
Study of the weighing of patients
Study of the measurement of blood pres
C. Social service
Impact of long-term hospitalization on the family unit
Frequency and description of situations acted upon by social workers in discharge planning
Patients' reactions to isolation
Symptom and behavior observations on a metabolic unit
Factors related to discharge planning
Emotional reactions of individuals to having eye disease
Changes in social function associated temporal lobectomy
Social implications of myasthenia gravi
Family relations in schizophrenia
Biosocial growth: couple study
Biosocial growth: nursery school study
College field study
College breakdown study
Biological study of schizophrenia
Family study of schizophrenia

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	3	38,683
	11	226,815
	12	473,071
	133	2,371,836

F ALLERGY AND INFECTIOUS DISEASES

Totals	Number	Dollar Volume
Extramural	1,440	$21,245,792
Intramural	172	6,510,299
	1,612	$27,756,091

GRANTS		
	135	$2,217,209
	50	553,563
	97	900,445
	379	5,694,276
	70	1,069,822
	9	120,018
	2	22,827
	3	87,487
	22	302,632
	119	1,884,978
	85	881,388
	187	1,980,525
	9	139,604
n	14	175,452
	7	107,025
	16	197,300
	236	4,911,241
	43	$1,541,930
	18	424,127
	4	434,102
	6	160,750
	17	472,170
	22	466,585
	9	199,933
	11	676,363
	17	393,490
	14	591,771
al		
sms	5	626,773
of diseases		
United States	6	522,305

LINICAL CENTER

Total	Number	Dollar Volume
Intramural	22	$73,454
	1	$ 2,500
	1	7,000
	1	9,900
	1	1,500
tients	1	6,644
f blood pressure	1	6,644
lization		
	1	3,850
of		
social		
ning	1	1,000
ation	1	400
rvations on		
	1	700
ge planning	1	4,000
viduals to		
	1	700
associated with		
	1	200
sthenia gravis	1	66
phrenia	2	3,700
tudy	1	6,350
school study	1	5,000
	1	5,650
	1	5,000
phrenia	1	800
enia	1	1,850

NATIONAL INSTITUTE OF DENTAL RESEARCH

Totals	Number	Dollar Volume
Extramural	333	$4,476,000
Intramural	65	1,534,898
	398	$6,010,898
EXTRAMURAL — RESEARCH GRANTS		
Dental caries	42	$596,793
Periodontal disease	27	357,233
Congenital anomalies	24	320,510
Neoplasms (oral cancer)	6	105,386
Malocclusion	6	49,746
Bone and enamel	24	252,299
Calcification	12	215,682
Saliva and salivary glands	21	259,409
Growth and development	16	198,598
Dental materials	14	113,025
Dental pulp	12	177,341
Aging and methodology of gerodontia	7	70,483
Radiation and methodology of radiology	6	140,584
Other, including basic research	116	1,618,911
INTRAMURAL		
Genetics studies	6	$98,907
Epidemiological studies	8	168,509
Experimental and clinical pathology and microbiological studies	19	380,978
Germfree studies	2	87,918
Nutritional and biochemical studies of dental caries and periodontal disease	5	131,877
Growth and development	3	135,540
Evaluation of investment procedures	2	65,938
Basic research	20	465,231

DIVISION OF GENERAL MEDICAL SCIENCES

Total	Number	Dollar Volume
Extramural	1,266	$22,949,656
EXTRAMURAL		
Basic biomedical sciences		
Chemical	334	$4,880,565
Physical	38	823,675
Biological	383	5,856,073
Preclinical	43	764,436
	798	$12,324,749
Clinical sciences	60	$1,422,775
Environmental health	250	4,979,719
Public health	28	1,309,632
Nursing	36	1,038,112
Miscellaneous	94	1,874,669

DIVISION OF BIOLOGICS STANDARDS

Total	Dollar Volume
Intramural	$681,000
INTRAMURAL	
Research on sterility and stability of biological products (general)	$43,000
Research on standardization of bacterial vaccines and antitoxins	95,000
Research on application of physical and chemical methods to the control of biological products	52,000
Research on strain characteristics and identification as related to control of viral and rickettsial biological products	135,000
Research on new and improved test procedures for viral and rickettsial biological products	254,000
Research on preparation, preservation, and safety testing of blood and blood products	102,000

Note: As the work of the Division is related to control activities, no significant figure can be given for the number of projects in each of the above categories.

EXHIBIT 10

SUBCOMMITTEE LETTER OF JULY 7, 1960, REQUESTING REPORT FROM NATIONAL INSTITUTES OF HEALTH ON EXTENT OF ITS RESEARCH ON BIOMEDICAL INFORMATION AND COMMUNICATION AND ON RELATED PROBLEMS

JULY 7, 1960.

DR. JAMES SHANNON,
Director, National Institutes of Health,
Bethesda, Md.
(Attention of Dr. Michael Shimkin).

DEAR DR. SHANNON: As you know, this subcommittee is now in the process of completing the series of its committee prints and drafting its substantive report.

I have listed below various items of information which are needed within the next few weeks and which I will appreciate receiving as soon as you and your busy staff can complete work on them.

* * * * * * *

Newly needed are:

(*a*) Estimated cumulative total of all funds obligated by NIH since its founding for exclusive purpose of research on biomedical communications, i.e., research on processes of scientist-to-scientist dissemination of information;

(*b*) Summary (including reprints) of any available information (outside of data from Institute of Medical Communication which we have) as to what is actually now known on communication of NIH or other biomedical research results: e.g., possibly data on what proportion of NIH extramural grants ever reach oral or published dissemination form; when, on the average, they reach such form (i.e., how long after original authorization of project); what proportion of published reports are estimated to have yielded negative rather than positive results; what are the factors, if any, that are correlated with high proportions of publication aside from reputation of investigator and intrinsic merit of a particular paper; what the estimated average time gap may be between date of approval of a given-type of manuscript for publication, and the date of its actual printing in primary and secondary medical journals, etc.

(Please note—I am referring herein exclusively to biomedical reports as such, not to any published information on communications research as regards the physical sciences, such as are available through the National Science Foundation and other sources.)

* * * * * * *

These inquiries, together with other past and future queries are extensive and time consuming to answer, I realize.

You, however, appreciate, I know, that these numerous requests are necessary by virtue of NIH's own central role and its special competence within the area of our broad survey.

With kindest personal regards and thanks for your fine cooperation, I am,

Sincerely,

HUBERT H. HUMPHREY,
Subcommittee Chairman.

EXHIBIT 11

LETTER OF AUGUST 22, 1960, FROM NATIONAL INSTITUTES OF HEALTH ON EXTENT OF ITS RESEARCH ON BIOMEDICAL INFORMATION AND COMMUNICATION AND ON RELATED PROBLEMS

NATIONAL INSTITUTES OF HEALTH,
Bethesda, Md., August 22, 1960.

DEAR MR. CHAIRMAN: In your letter of July 7, with reference to the forthcoming committee print on "Biomedical Information," you requested an estimate of the total funds spent by NIH on research in this field and raised a number of questions about the present state of biomedical research communication.

Grants made by the National Institutes of Health for biomedical information research through June 30, 1960, total a little over $1 million. This includes grants for fundamental and applied study of and experimentation with new or nonconventional methods, systems, and machines for biomedical information tasks; surveys to identify the major technical problems in the field; research in linguistics and communication theory; and studies of classification and indexing methods.

The growth of the program is shown in the following table:

NIH grants for biomedical information research

Fiscal year:		Fiscal year—Continued	
1948	0	1956	$44,756
1949	0	1957	52,103
1950	$38,312	1958	19,770
1951	65,755	1959	246,667
1952	68,833	1960	335,419
1953	53,679		
1954	44,575	Total	1,009,176
1955	39,307		

The rapid increase in national expenditure on medical research during the past 5 years has, of course, magnified and complicated the problems of making research results available to other investigators and practitioners. The sharp rise in the funds devoted to research in this field during the past 2 years reflects the growing concern of the advisory councils and the NIH staff and the heightened interest of communication experts in designing suitable research projects relating to biomedical information. Some $300,000 has already been obligated for the current fiscal year and the final figure will undoubtedly show a substantial increase over fiscal year 1960.

During this same period (1948–60) NIH devoted almost $11 million of its extramural funds to the dissemination of biomedical research information. This includes grants for the publication of research data; for the collection, acquisition, and storage of scientific and technical documentary material; for bibliographic organization and processing to enhance the availability and usefulness of data; for providing information services to users; for symposia and meetings; and for other information services and activities. Expenditure for these purposes is shown in the following table:

Biomedical information activities (other than information research)

Fiscal year:		Fiscal year—Continued	
1948	$84,009	1956	$249,466
1949	93,476	1957	1,237,301
1950	190,689	1958	1,683,132
1951	205,527	1959	2,323,988
1952	180,926	1960	3,894,139
1953	133,198		
1954	296,332	Total	10,856,869
1955	284,686		

Quantitative answers to the questions raised in paragraph 4(b) of your letter under reference are not available. In any case, I doubt that summary statistics giving average or percentage figures regarding the productivity of research projects would have much validity. For example, virtually all research results "reach oral or published dissemination form" to some extent—but the extent varies from oral communication to a small group of colleagues engaged in the same narrow area of research to worldwide publication. Much depends on the nature and significance of the results, the specific field of research, the number and intimacy of the scientists in the particular field and the kind of channels they normally use for communication.

The time lag also varies with the field depending partly on the relationship between the number of papers produced and the number and size of the scientific meetings and publications available. But the temperament of the investigator is another important factor: some like to leap into print whenever they have two pieces of data to rub together while others prefer painstakingly to assemble a comprehensive set of results. The latter course takes longer but the delay is often more than offset by the time and effort saved other investigators in piecing together the fragmented published data. Furthermore, as the time required for a research project ranges (sometimes quite unpredictably) from a few months to many years, it would be highly misleading to attempt to compute the average elapsed time between the authorization of a project and the publication of results.

There would be a similar danger in counting—if it were possible—so-called negative results. What might be called blank results are rarely published; if an investigator looking for a drug to serve a specific purpose fails to find it, he is not likely to produce a paper or to find a publisher if he did. On the other hand, if a drug being investigated fails to have the theoretically expected effect, the

negative result may be a highly significant clue to unexplained chemical or physiological phenomena and be well worth publication.

The inherent and unavoidable difficulties in arriving at any statistical statements concerning the productivity of medical research or the efficacy of research communication are somewhat more fully discussed in the enclosed paper by Dr. Ernest Allen which you may find of interest.

Sincerely yours,

JAMES A. SHANNON, *Director.*

WHAT ARE WE GETTING FOR OUR MONEY?

(Memorandum by Ernest M. Allen, Chief, Division of Research Grants)

Two questions are continuously in the background—looking over the shoulder—of those who administer Federal programs of grants for medical research. One is the question of impartiality or freedom from geographic or institutional or other bias in the award of grant funds; the other, the question of what is bought for the money expended. Both matters deserve continuous monitoring. This discussion will be addressed to the second. The question can be conveniently analyzed into half a dozen component questions which will be given attention in turn.

1. What percentage of NIH grants are fruitful?

This question, or the somewhat more precise "What percentage of NIH-supported research projects are productive?" can be asked of all medical research, regardless of source of support, and the one should accompany the other. For the NIH and for the Nation at large, an even more precise question directed toward the same objective would be, "What is the fruitfulness of medical research per $100,000 invested?"

However the question is phrased, the two—NIH and total national—should be examined in parallel, over the same period of time, for productivity or fruitfulness of NIH-supported research can be judged only as it is contrasted with comparable data for the Nation. NIH-supported projects should be no less fruitful than the national average.

No research is fruitful if its findings never come to publication. Publication, whether the results are positive or negative, must indeed be regarded as an integral part of the research undertaking: the research is not complete until the information obtained becomes part of the recorded findings in the scientific field.

Every research undertaking, unless interrupted by death or some other untoward factor over which the investigator has no control, leads to one of three outcomes: The result of the research is either—

(1) Positive, giving support to the initial hypothesis; or
(2) Negative, failing to support it, or
(3) Inconclusive.

It can be said with complete assurance that every well-conceived research that has led to definitive results, i.e., either positive or negative, comes to publication. The results are usually first reported before an audience of the professional society in whose area of interest the work belongs and are published usually in abstract in its transactions. The work is then reported more fully in one of the scientific journals.

Failure to publish either positive or negative results would be extraordinary, for the scientist's advancement in the esteem of his colleagues, both in his institution and in his scientific field, depends on his productivity. The number of his papers is a first approximation as a measure of this productivity.

Inconclusive results signify that the research has not been carried to completion. It may be that the possibility of inconclusive results was foreseen in the beginning but the chance taken, nevertheless, because of the importance of the problem; or it may be that an unexpected difficulty has arisen. Any problem worth doing is likely to involve some technical difficulty, whether foreseen or not, and the difficulty of the problem is likely to be correlated with its importance.

Editors of medical scientific journals, and their scientist audiences alike, take a dim view of publication of inconclusive results. Costs of publication run from $25 to $40 or more per journal page, and accumulated reports of conclusive results, positive or negative, are always waiting to be published. Editors and readers prefer to see priority given to such reports, and reports of defeats are

accordingly crowded out. The rare exception might be some monumental effort, like an unsuccessful Manhattan project, whose details would be recorded for the benefit of others who might be tempted to attack the problem again before advances in technology gave more promise of successful attack.

As far as the writer has been able to discover, the proportion of failures of attack, where neither positive nor negative results are obtained, in the national total of medical research projects undertaken in any period, has never been determined or authoritatively estimated. There is, of course, some degree of risk of defeat in almost any but the most pedestrian of research undertakings. The comparative physiologist who secures funds for a study of the heart rate of the snake will assuredly find a way to count the animal's heartbeats; the biochemist who attempts the synthesis of insulin may fail, with nothing to publish for his pains.

What is the proportion of such failures in the experience of the NIH? Here again the answer at this writing is that no count or authoritative estimate has been made and indeed should not be until the question can be examined for the NIH and for all medical research simultaneously. For if it were found the 0.1 percent or 1 percent or 10 percent of projects undertaken with NIH grant funds are abandoned because of technical difficulties, the figure, whatever it was, would have to be compared with the national percentage to know what corrective action, if any, should be undertaken. But even if the national percentage were also known, the direction of action, if any seemed to be indicated, could not be known without still further information. For let it be assumed that for NIH-supported research the percentage of defeated undertakings was twice the national percentage: If it could be established that the excess of failures was due to ill-judged research ventures, the difference would be measure of a fault, but if it were traceable to a larger proportion of difficult research problems, the same difference would have to be regarded as the expression of a virtue.

It might be added here that if NIH-supported projects averaged a higher level of difficulty than the national level, bearing in mind that the scientific importance of problems and their difficulty are to some extent correlated, it would be reasonable to expect that by any valid measure the average fruitfulness for NIH-supported research would be higher than the national for all medical research in the country.

Finally, in regard to the unknown proportion of research undertakings that never come to publication, it is the writer's recommendation that no study of this be undertaken and that a more direct attack be made, if any is contemplated, on the question of the fruitfulness of NIH-sponsored versus all medical research. The presumptive evidence at present would support the view that NIH-supported research is more fruitful, or certainly not less so, than the national average.

Here it should be pointed out that a count of the number of papers flowing from any one research project, or from any one research institution, cannot be used as a measure of research fruitfulness or productivity in comparison with counts from other projects or institutions. Counts of this nature are, to be sure, approximations of medical research productivity and are valid even without correction when two large random samples are to be compared. But when it is desired to compare the research productivity of two selected geographic areas, or sources of support, or institutions or projects, or to compare productivity of any one of these with the national average, the count of papers (N) must be compounded with another and intangible factor (M) representing scientific importance, in order to arrive at a valid measure or index (P) of fruitfulness or productivity:

$$P=MN$$

It is important to note that a prior and explicit[3] evaluation of merit (M) is made for each research project for which grant is awarded through the NIH, and that an evaluation of M for any research that the investigator may have already published, although it is not explicit, nevertheless plays a part as a factor (though not necessarily a determining factor) in action on any research grant application.

[3] In the study section priority rating.

2. What is the average time interval between award of grant and publication of results?

Averages for the different fields of investigation and different types of research, and overall averages, have not as yet been computed, but a study of the question is already past the planning stage. The information will be of interest to both scientists and administrators, and if its publication is followed up by attempt at identification and judicious effort at correction of factors acting to lengthen the interval, the whole study can be of considerable value.

3. What is the proportion of negative versus positive results from grant-supported research?

A simple example of negative results as the term is used here is finding that some specified organic compound included in a screening program has no action to retard the growth of implanted mouse sarcoma. The proportion of research projects yielding negative results, as compared with positive, has never, to the writer's knowledge, been computed or authoritatively estimated.

At first thought it might appear that negative results for a study are clear evidence of bad judgment in the investigator who planned it. Since, however, the scientist may be moved to test a hypothesis in order to disprove it, bad judgment cannot always be claimed. Furthermore, here, as in the matter of fruitfulness, one must have a background figure for comparison. It seems unlikely that any scientist has throughout his career always guessed right in his predictions of what would happen if a matter were put to test. Indeed, such a man, if found, might prove to have been the least venturesome of those who probe the unknown, betting always on a safe thing. Determination of the national average percentage of medical research projects yielding negative results might be made in order to establish par for the general level of judgment of medical scientists (corrected, of course, for the small proportion of researches undertaken to disprove something). Such an average for each of the fields of medical science would be informative. Percentages for NIH-supported research computed for the same time period could then be compared with these background averages.

It seems likely that the comparison would be highly favorable to the NIH-supported projects as a group, inasmuch as every research undertaking so financed has had the prior approval of 15 to 20 distinguished scientists active in the same general field.

4. What is the time interval between acceptance of a paper by a journal and the paper's appearance in print?

For the American Journal of Physiology the interval is roughly 3 months, but certainly is longer for many journals. In any case the delay is onerous to the scientists who write the papers, and retards somewhat the progress of medical research. One factor in the delay is the other accepted papers that may be waiting for publication, but unless the delay interval is slowly increasing, this waiting list is not in itself evidence that the journal needs to be expanded. Another factor is the composition and press time, which may be lengthened by more waiting in the offices of firms that hold journal composition and printing contracts.

5. What are the factors in research productivity?

This is the most important of the questions discussed in this paper and deserves continuous study by a great granting agency. If action beyond the limits of mere study should be contemplated, it would require prior consultation at every step with educators and scientists representative of their professional communities, and no step should be taken without their approval.

The factors begin to operate at the high school level or earlier, in influences that would lead the more talented youth to choose medical scientific careers. Idealism is a factor, for service to humanity is a major appeal. Honor and esteem from one's fellows are factors acting at the choice of career level. Assured income to take care of family and old age is another. Cost of preparation is still another.

All of these are factors in the intellectual equipment and aptitude of the coming generation of scientists.

For those who now compose our population of scientists, the principal factors in productivity are: (1) receipt of information of the findings (and ideas) of other scientists through the printed page, attendance at scientific meetings and visits to the laboratories of other scientists; (2) time to think (as well as to read and discuss); (3) freedom from anxiety over personal problems (e.g., inadequate income or insecure tenure) or actual or threatened professional problems (e.g., need for research funds or space; feared restrictions on freedom to advance research in any direction, unhampered by any interference whatsoever that might retard progress); (4) ample research time, facilities, equipment, and personnel, secured with a minimum of delay; (5) continuity of research support, to permit assured forward planning.

This discussion has not attempted to cover certain other aspects of "what we are getting for our money." One, the expansion of research manpower and research potential now going on as a byproduct of research projects supported through NIH-administered funds, deserves a separate report.

In conclusion, the NIH has sought and is continuing to seek, with the guiding advice of the scientific community, to give continuing and due attention within the limits of its mandate and funds to the matters discussed and thus to achieve the maximum of return presently possible for research funds expended.

SUPPLEMENT TO SENATE, HOUSE HEARINGS

Senator HUMPHREY. We know, Dr. Shannon, that you have developed information for us which will prove useful in the future in both the executive and legislative branches. It will supplement the outstanding body of information which is gathered each year by the two subcommittees which, more than any others, are expert in NIH's work.

I refer, of course, to the Senate and House Subcommittees on Appropriations for the Departments of Labor, and Health, Education, and Welfare. These are, of course, headed by Senator Lister Hill of Alabama, the dean of Congress, health legislation, and Congressman John Fogarty of Rhode Island, respectively.

No publications have proven more useful to our own study, more valuable of insight or complete of information than have the hearings and reports of these two distinguished groups, together with similar publications on the part of the Senate Labor and Public Welfare Committee also headed by Senator Hill and the House Committee on Interstate and Foreign Commerce. The latter's chairman is the Honorable Oren Harris of Arkansas, and its Subcommittee on Health and Safety is headed by Congressman Kenneth Roberts of Alabama.

COMMUNICATION BETWEEN INSTITUTES THROUGH INDEX CONTROL

Earlier, I pointed out that interagency scientific cooperation may hinge on interagency efficiency in management of information. It would be difficult to assure maximum coordination and communication between agencies unless each agency had first organized its internal files and records so as to be able to keep track and to report on what it itself is doing.

Information retrieval has become a science and an art. A layman's approach appears no longer adequate. A union appears essential between the services of information specialists, and the services of scientists who know the technical subjects.

In our subcommittee review of interagency information problems, we have, therefore, asked such questions as:

(1) Is it comparatively easy—through use of similar terms—for a person in agency A or institute A to identify a subject of common interest to agencies B and C or institute B?

(2) What is the relationship between the index system of the Bio-Sciences Information Exchange and the internal index systems of other agencies, particularly the National Institutes of Health; that is, to what extent, if any, are the systems compatible?

(3) To what extent are the various intraagency systems actually used and, specifically, by whom, within an agency, much less by other agencies seeking information?

Any given research project can, of course, be indexed in so many ways, by so many terms and descriptors that it is questionable whether the human mind—unassisted by mechanical means—can efficiently store, index, and retrieve sufficiently, promptly, and reliably.

Ultimately, therefore, I believe, the agencies may be required by the sheer mass of data to turn to electronic processing methods. The task already appears too heavy for a laborious, manual approach, even within many agencies, much less between agencies.

What may appear to one agency as a minor phase of one research project may represent a crucial phase to another agency which is working from a different angle and point of view but can use the first agency's insight.

REPLY FROM NIH ON INSTITUTE INDEXING SYSTEMS

As an initial step, in compiling necessary data on existing programs, I asked NIH to prepare a brief summary, describing the various index-control systems within the respective Institutes and the Division of General Medical Sciences.

My inquiry and NIH's response appear as appendix B at the conclusion of this volume. There is, it will be noted, a considerable variety in systems used by the respective institutes.

THREE THOUSAND DEPARTMENT OF AGRICULTURE PROJECTS

Senator HUMPHREY. Now we have here the representative of the Department of Agriculture. You are Dr. Irving.

Dr. Irving, how many projects have you? Somewhere along the line, I remember the figure 3,000 or so.

Dr. IRVING. Yes, 3,000, sir.

Senator HUMPHREY. You have about 3,000 intramural projects?

Dr. IRVING. About 3,000 total, I believe, is the figure, Senator. Some 300 of these are medically related.

Senator HUMPHREY. I am talking about these 300 in medical science.

Dr. IRVING. Yes, sir.

Senator HUMPHREY. Of definite interest to medical science. Our preliminary research indicates—through your cooperation, may I say; we would not be able to do this without your cooperation—320 intramural projects, 610 extramural; that is where you are doing work outside of the department?

Dr. IRVING. That is correct.

Senator HUMPHREY. And there is a substantial sum of money involved in these projects, altogether a little over $16 million.

POLICY ON REGISTRATION WITH BSIE

Do you register with the information exchange any of these 300-plus medically oriented projects?

Dr. IRVING. None of them is now registered, to my knowledge, Senator.

Senator HUMPHREY. Then how do the good friends of ours in NIH know what the good friends are doing in Agriculture except when you folks just sort of get together?

I am afraid, as I see it, that there is too much reliance upon memory.

Now, my problem, as a Senator, is that it is one thing to rely on memory, but, as you get a little busier, it is better to have a notebook. It is well to remember that you were tought also to write and not just to read.

So I write things down in a notebook, unless I want to lose my constituents. I am of the opinion that the purpose of this information exchange was to put it down "in the notebook," so to speak, so the people could see it. What is your rationalization, or your justification, for no registration with the Bio-Sciences Information Exchange?

Dr. IRVING. We might answer that briefly, to begin with, and then amplify it, if you wish.

I think we should. I concur with Dr. Shannon. I think we should avail ourselves of the facilities of the Bio-Sciences Information Exchange and use it more than we have.

USDA CENTRAL PROJECT OFFICE

The situation in which we now find ourselves is this: We do have a central project office in the Department of Agriculture where all projects are registered.

Senator HUMPHREY. Yes.

Dr. IRVING. The current projects are available for inspection of all scientists everywhere.

We periodically issue lists of these projects with a short abstract as well as a title indicating what these projects are intended to do.

These are available to all interested scientists who seek to find what the Department of Agriculture is doing and so ascertain its relationship to work that they may be doing or intend to do.

Senator HUMPHREY. Do you have an index?

Dr. IRVING. These projects are indexed in the Department of Agriculture and the lists are issued in booklets arranged by categories and by commodities.

Senator HUMPHREY. Are those made available to the Library of Congress?

Dr. IRVING. They are available to the Library of Congress. However, the Library is not on our mailing list.

Senator HUMPHREY. The Library of Congress index service on research projects?

Dr. IRVING. I am not certain on that point.

DISTRIBUTION OF LISTS

Senator MUNDT. Where are the lists sent? Are they sent out among scientists, or what is done with the lists?

Dr. IRVING. The group to whom these lists are sent is largely an agricultural group. They are sent to all of the State agricultural experimental stations. They also reach the members of our research advisory committees, veterinary science schools, and other agencies in the Federal Government that conduct scientific research.

Senator MUNDT. Medical schools, I suppose, all the medical schools of the country, too?

Dr. IRVING. Of medical schools, I am not certain, sir, but probably not.

Senator MUNDT. You deal with human health, not only with animals?

Dr. IRVING. Research using about 14 percent of our funds might be classed as medical or at least bioscience related in the context of this hearing. The $16 million that you indicated earlier, Senator Humphrey, represents about 14 percent of the Department's research effort.

Senator HUMPHREY. Fats and oils relating to cholesterol and what, if any, relationship to heart disease; that is the type of subject within the purview of some of your scientific investigations, is it not?

Dr. IRVING. Yes, and that is included in the projects that were reported to you.

Senator HUMPHREY. This is very important to Dr. Watt, I would imagine, and very important to the NIH and also in the medical schools.

Let me reiterate that what we are doing here is trying to help each other. This is why we have this kind of a session. This is not a session of harassment. It is a session to try to see if we might collectively come to some better understanding of how we can promote closer coordination.

GAPS IN RADIATION REGISTRATION

For example, our preliminary investigation indicated that the on-site laboratories of the Atomic Energy Commission up until now did not register with the Bio-Sciences Exchange. Now they have hundreds of projects of a very vital nature to the health of mankind under the AEC. And will you correct me, Julius, if I am in error, but I believe even internationally, we have had difficulty getting, for example, in the one instance in West Germany what the Germans are doing in radiation tracers, for example, which is a very vital tool of medical research.

We have not been able to get much information or we have encountered difficulty in getting prompt information from certain countries. This, of course, gets into the field of international cooperation. What I am groping for—and I am a layman in this—what I am groping for, in a sense, is to say that there is a great deal of good work, I am sure, that is going on, far beyond what I would appreciate

anyway. But whether or not even the scientific community is fully aware sometimes of the scope of all the good work will be determined pretty much by the prompt availability of useful descriptive data.

In other words, we ought to be able literally to put our finger on a button in one of these electronic machines and come up with information on what is going on, at least an index of what the current research is.

LIST OF NIH EMPLOYEES' ARTICLES

Now on another point, I noticed, Dr. Shannon, the publication, "Scientific Directory and Annual Bibliography of the National Institutes of Health, 1960." These are the lists of published articles.

Dr. SHANNON. Yes.

Senator HUMPHREY. But actually this is not a current list of research; it is a listing of articles based on research performed in 1956 or 1957, not 1959 and 1960. Now is there a reason for concentration on published articles? I am not being unduly critical of the absence of a current listing and of the inevitable delay in citing published articles. The delay is obviously because, in part, before a lot of these articles are published, there is frequently a long waiting list. You sort of queue up to get your article published in some of these journals, particularly in a highly important field and in an important journal.

But there is a lag period prior to publication. We went through this, Walter Reynolds, in the field of translation. We were worried about the lag period in the field of translation from other languages into English and vice versa. But now we have no listing by NIH of its intramural research, in other words, a lag here in the field of current research, where research may be conducted which will ultimately prove to be negative, for example.

There ought to be a report that "project X was a blind alley." Where research was conducted and was partially positive in results, there ought to be updating all the time through progress reports. Few people will know about it unless the Bio-Sciences Information Exchange is given current information on both intramural and extramural projects.

THE INVESTIGATOR'S TYPE OF APPROACH

Dr. SHANNON. Senator Humphrey, could I comment on that? I think we are getting into an area of the use of this information that, whether I am right or wrong, I at least have very strong feelings about. I would like to look at the Bio-Sciences Exchange for what it is and what it can do, but I also would like to look at it from what it cannot be expected to do and where it cannot be expected to help.

I think without the information that we get from the Bio-Sciences Exchange, we could not run an intelligent grant mechanism. On the other hand, were I an investigator in the field, as I was for many years before assuming my present responsibility, I would be less concerned with what is going on now than what had been accomplished and had been published as firm fact.

LIMITATION ON VALUE OF PROJECT SUMMARIES

Now I would be very much distressed, as I am now, at the delay in the publication of these published facts—the multiple journals I would have to look at in order to develop the information that I would have to have in order to take the next research step forward. But I would not be concerned with the type of information that is on tabulation with the BSIE, in determining the course of my research.

In the framework of our present support program, whether this be AEC, NIH, or a voluntary agency, one must appreciate that the BSIE can only record intentions of investigators at a given point of time.

Now initially these are intentions that are just proposals. They are not necessarily grants. At a later time, they become grants. This man then marks out an area that he proposes to explore by certain general devices. He becomes of importance to me as an investigator only after that exploration is completed and after results that will have a bearing on my work become available.

What would make me impatient is that there might be a delay of a year in the publication of those results. Even if they are published, it may take me the better part of a year before I turned up the fact that this work had been done with the multiplication of our journals and the tremendous reading load which the rapid pace of current science imposes upon our investigators.

But we are getting over now to another area of inquiry, namely, that of storage and retrieval of information, rather than the type of things that the BSIE is so well set up to do, to develop the data upon which management can depend in its policy decisions relative to the direction of the conduct of its very broad program. So I would like to differentiate.

Senator HUMPHREY. We might get away from this matter for a moment, because I think our time problem is pressing us. I think we have highlighted this problem. Now let's see what the nature of other problems are.

The solutions, of course, are not quite as handy as the knowledge of the nature of the problems.

BIO-SCIENCES INFORMATION EXCHANGE

In the preliminary inquiry that I made in working with our staff, we note, for example, as we referred to earlier today, that there is what is now called the Bio-Sciences Information Exchange.

That is under the guidance or jurisdiction of the Smithsonian Institution. The purpose of that Bio-Sciences Information Exchange is, in part, to keep a current up-to-date index of the research projects underway in which the Federal Government has any participation; that is one of the general purposes; is that correct?

Dr. SHANNON. I would only add one thing. The Bio-Sciences Information Exchange encompasses in its activities all of the activities of the voluntary, the large voluntary agencies.

Senator HUMPHREY. If they cooperate.

Dr. SHANNON. Most large ones do, sir.

REGISTRATION OF INTRAMURAL AND EXTRAMURAL PROJECTS

Senator HUMPHREY. Yes, sir. All right.

Now, there are two kinds of projects at NIH, for example, in broad areas, as I see them.

You have the grant projects where you give grants to, say, the University of Michigan, the University of Minnesota, the University of Maine, the University of South Dakota——

Senator MUNDT. Thank you.

Senator HUMPHREY. We will get them all in here. And you take care of a host of applications through your councils on grants. Then you have intramural research.

Dr. SHANNON. Yes, sir.

Senator HUMPHREY. That is work done largely over here in the institutes at the facilities in Bethesda.

Dr. SHANNON. Yes, sir.

Senator HUMPHREY. As I understand it, the research projects that are under grants are pretty well tabulated with the Bio-Sciences Information Exchange, but there is about $50 million worth of intramural research going on over in your shop.

Why doesn't the NIH register project summaries with the Information Exchange on these projects?

Dr. SHANNON. Well, Senator Humphrey, I think we should.

Senator HUMPHREY. Good. I hope you will.

PUBLIC HEALTH SERVICE REGISTRATION

Now, since I have noted the fact that NIH registers extramural work but does not register intramural projects with BSIE, certain other inclusions and omissions by the Public Health Service should also be noted.

There follows a BSIE response to an inquiry as to which PHS programs are and are not registered.

EXHIBIT 12

LETTER OF MAY 20, 1960, FROM BIO-SCIENCES INFORMATION EXCHANGE DESCRIBING EXTENT OF COVERAGE OF RESEARCH PROJECTS SUPPORTED BY U.S. PUBLIC HEALTH SERVICE

SMITHSONIAN INSTITUTION,
BIO-SCIENCES INFORMATION EXCHANGE,
Washington, May 20, 1960.

DEAR MR. CAHN: * * *

All research grants reviewed by the National Institutes of Health Study Sections and the various councils are registered with the Exchange. In the specific areas of your interest, the following programs are registered and are current:

1. Nursing (projects identified as GN–RGN).
2. Air pollution (projects identified as S).

3. Water pollution (projects identified as K).
4. Hospital facilities research program (projects identified as W).

Awards other than research, i.e., fellowships, traineeships, control, and construction, are not within the scope of the Exchange.

Awards not reviewed by the National Institutes of Health Study Sections and Public Health Service Advisory Councils but made through Public Health Service facilities in such places as Atlanta or Cincinnati are not registered with the BSIE.

As you know, the intramural studies of the Public Health Service are not registered.

With kindest regards,

Sincerely,

STELLA LECHE DEIGNAN, *Director.*

COMMITTEE'S PAST STUDY

Senator HUMPHREY. Yes, sir. I think I have a layman's appreciation of the differentiation between intramural and extramural research because we have put long, and sometimes, I thought, maybe fruitless, hours in evaluating how results of both types are disseminated through documentation and indexing and retrieval. This has been a labor of love, I assure you. We have not accused anybody of anything, so it has not made any headlines, but at least we think it has done some good.

SUBJECT-TYPE INQUIRIES ON HEART RESEARCH

I want to move along here, Doctor. We have so many others of your associates here that I think we ought to get some contributions from them. I have a question here for Dr. Watt relating to the utilization of the Bio-Sciences Information Exchange service.

Dr. Watt, I note that in 1959, 228 subject-type requests were made of BSIE by NIH's Division of Research Grants. I suppose that a number of these involve heart disease. There were only 37 subject-type requests that were made from the National Heart Institute itself. Yet the Heart Institute supports over 1,800 extramural projects alone.

I understand, of course, that a single project request might bring information on literally scores of projects, but do you think 37 requests, a little more than 3 per month, indicates a great deal of curiosity about the hundreds of projects being performed by other Government agencies which possibly involve the cardiovascular field?

SUBJECT-TYPE REQUESTS FROM NIH

I shall ask that there appear here a table, based on a letter from BSIE prepared at our request, tabulating for NIH as a whole, its subject-type requests during 1959.

EXHIBIT 13

EXCERPT FROM LETTER OF AUGUST 5, 1960, FROM BIO-SCIENCES INFORMATION EXCHANGE ON REQUESTS FROM NATIONAL INSTITUTES OF HEALTH FOR SUBJECT-TYPE INFORMATION

I. A BREAKDOWN OF THE 307 NIH SUBJECT REQUESTS IN CALENDAR 1959

The majority of subject requests come through the Division of Research Grants which services all institutes; thus the following breakdown does not really reflect the information as used by the individual institutes.

National Institute of Mental Health	30
National Heart Institute	37
National Institute of Neurological Diseases and Blindness	9
National Cancer Institute	3
Division of Research Grants	228
Total	307

WORK OF STUDY SECTIONS AND HEART COUNCIL

Dr. WATT. Mr. Chairman, actually the requests that are made by NIH on a general basis are, of course, available to us, and individual requests that we make as an institute are not necessarily a reflection of the information obtained generally from Bio-Sciences Information Exchange. I think that the data actually needed for planning, in terms of the information obtained from the Bio-Sciences Information Exchange is really obtained best on a centralized basis, because the study sections, which review these applications, are serving all institutes, not just the Heart Institute.

The study sections, as set up, receive applications and review them on a scientific merit basis, not just for the Heart Institute but for the Cancer, Mental Health, and the rest of the institutes. So that when a request comes in, it is fed to the study section to pass on its scientific merit. This is done by the study section, you see, in reviewing not just the heart field but others that bear a relationship to it.

When we have information brought to the Heart Council from Bio-Sciences, we use information not only from that source but also our own more detailed review of our own projects.

So I think that the number of requests really is not a very good indicator of the degree of curiosity nor of the amount of use that is made of the information available from this source.

Senator HUMPHREY. I think we took some note of that in terms of the total number of requests, some 200 requests from NIH's Division of Research Grants.

Dr. WATT. That is right.

EX OFFICIO MEMBERS OF HEART COUNCIL

Senator HUMPHREY. I mentioned that some of those are related to the heart field. Let's get down here to this intramural business again. I notice that you have three ex officio members who serve on the National Advisory Heart Council.

Dr. WATT. That is right, sir.

Senator HUMPHREY. Dr. Middleton of the Veterans' Administration.

Dr. WATT. He has a man designated.

Senator HUMPHREY. Yes. And Dr. Berry of the Department of Defense; and the Surgeon General, Dr. Burney. I suppose they designate their representatives?

Dr. WATT. I represent Dr. Burney, of course, and Captain Pearson of the Navy is the current representative from the Department of Defense.

DEPARTMENT OF DEFENSE CARDIOVASCULAR PROJECTS

Senator HUMPHREY. Yes, sir. The question I would like to ask is this: How can the Department of Defense representative, for example, bring to bear with NIH information on heart disease research being carried out within the Department of Defense which might overlap with NIH research, if the Department of Defense has never had available central information on its own intramural cardiovascular research program until just recently.

I think we had a little something to do with them to get them to register with the Bio-Sciences Information Exchange. But here for a considerable period of time, considerable sums of money have been expended by either the Army or the Navy or the Air Force in the Department of Defense for research which may touch upon, and I am sure does, cardiovascular research. Yet there was never any registration of the intramural projects of the Department of Defense with the BSIE. How, then, would NIH know what DOD was up to?

Dr. WATT. I can't speak for the representatives who come, but at the council meetings, Senator Humphrey, they do have and give us quite a bit of information about what goes on. I assume that they have done this through the use of their own centralized information service.

Senator HUMPHREY. For their own people. But do you have their own centralized——

Dr. WATT. They attend our council meetings. These representatives are there and participate as a member of the council in the decision and in the discussion of our own programs.

Senator HUMPHREY. Apparently they have seen the need to change.

Now may I say this on the matter of intra-agency and interagency circulation of analyses.

ANALYSES OF CARDIOVASCULAR GRANTS

One of the advantages of BSIE as I see it is that it permits Government-wide analysis of scientific trends, so as to supplement the internal analyses which are made by individual agencies. Thereby, each agency can see the overall trends, the new directions; the possible coming problems of shortages of skilled manpower in particular disciplines; the decline of subjects which used to be of top interest.

The National Heart Institute is sending at our request a number of helpful analyses which it has made. To my way of thinking, this type of analysis can be invaluable especially if it is on not only an intra-agency but on an interagency basis.

I am going to ask that the record reproduce a few of the analyses which are being transmitted to us at our request by NHI.

The material follows:

EXHIBIT 14

ANALYSES BY NATIONAL HEART INSTITUTE ON NATURE OF AWARDS BY RESEARCH AREA AND DISCIPLINE

Summary of awards by research areas, fiscal years 1949–59, in dollars and in percentages of total appropriation

	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959[1]
Arteriosclerosis	$0.452	$1.146	$1.284	$1.58	$1.51	$1.73	$2.234	$2.58	$5.47	$6.08	$7.64
Percent	30.3	28.9	29.06	32.89	29.3	25.3	28.83	30.2	30.1	31.4	33.86
Hypertension	$0.326	$0.828	$0.711	$0.83	$0.86	$1.43	$1.152	$1.19	$2.91	$2.36	$2.67
Percent	21.9	20.9	16.08	17.22	16.8	20.9	14.86	13.9	16.0	12.2	11.81
Congenital heart disease	$0.033	$0.226	$0.301	$0.33	$0.38	$0.44	$0.502	$0.43	$1.13	$1.34	$1.60
Percent	2.2	5.7	6.82	6.75	7.5	6.4	6.47	5.0	6.2	6.9	7.08
Rheumatic heart disease	$0.061	$0.218	$0.427	$0.17	$0.30	$0.26	$0.398	$0.45	$0.82	$0.81	$0.88
Percent	4.1	5.5	9.67	3.61	5.8	3.8	5.14	5.3	4.5	4.2	3.88
Rheumatic fever	$0.064	$0.234	$0.323	$0.18	$0.24	$0.31	$0.370	$0.43	$0.53	$0.56	$0.62
Percent	4.3	5.9	7.30	3.78	4.6	4.6	4.77	5.0	2.9	2.9	2.77
Aging	$0.118	$0.230	$0.174	$0.11	$0.15	$0.25	$0.257	$0.26	$0.58	$0.97	$1.26
Percent	7.9	5.8	3.93	2.20	2.9	3.7	3.32	3.1	3.2	5.0	5.57
Heart failure	$0.203	$0.503	$0.594	$0.57	$0.62	$0.74	$0.836	$0.87	$1.68	$1.76	$1.81
Percent	13.6	12.7	13.45	11.89	12.0	10.8	10.79	10.2	9.2	9.1	8.02
Other diseases of the heart and blood vessels	$0.122	$0.385	$0.347	$0.30	$0.43	$0.58	$0.909	$0.92	$2.13	$2.46	$2.63
Percent	8.2	9.7	7.84	6.14	8.3	8.5	11.73	10.8	11.7	12.7	11.67
Diseases of blood	$0.022	$0.032	$0.080	$0.53	$0.41	$0.75	$0.539	$0.64	$1.15	$1.32	$1.50
Percent	1.5	0.8	1.81	11.11	8.0	10.9	6.95	7.5	6.3	6.8	6.64
Diseases of lung	$0.012	$0.063	$0.065	$0.077	$0.10	$0.12	$0.136	$0.14	$0.40	$0.48	$0.71
Percent	0.8	1.6	1.47	1.60	1.9	1.8	1.76	1.7	2.2	2.5	3.17
Diseases of kidney	$0.039	$0.063	$0.072	$0.089	$0.09	$0.14	$0.205	$0.23	$0.45	$0.46	$0.53
Percent	2.6	1.6	1.62	1.87	1.8	2.0	2.65	2.7	2.5	2.4	2.36
Diseases of liver	$0.021	$0.028	$0.038	$0.041	$0.04	$0.03	$0.038	$0.08	$0.13	$0.14	$0.18
Percent	1.4	0.7	0.86	0.87	0.8	0.5	0.49	0.9	0.7	0.7	0.79
Diseases of endocrine glands	------	$0.004	------	------	------	------	$0.006	$0.04	$0.05	$0.02	$0.02
Percent	------	0.1	------	------	------	------	0.07	0.5	0.3	0.1	0.09
Other organs, tissues, cells, and basic mechanisms	$0.018	$0.004	$0.004	$0.003	$0.02	$0.06	$0.168	$0.27	$0.76	$0.60	$0.52
Percent	1.2	0.1	0.09	0.07	0.3	0.8	2.17	3.2	4.2	3.1	2.29
Total	$1.491	$3.964	$4.420	$4.810	$5.15	$6.84	$7.750	$8.53	$18.19	$19.36	$22.57
	100	100	100	100	100	100	100	100	100	100	100

[1] 1959 figures do not include recommendations of February 1959 Council.

Summary of awards by disciplines, fiscal years 1949–59, in dollars and percentages of total appropriations

	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959[1]
Anesthesiology	$0.011	$0.059	$0.050	$0.063	$0.094	$0.078	$0.097	$0.108	$0.200	$0.17	$0.18
Percent	0.71	1.48	1.13	1.31	1.82	1.14	1.25	1.26	1.1	0.9	0.78
Biochemistry	$0.140	$0.270	$0.331	$0.340	$0.404	$0.681	$0.627	$0.770	$1.710	$1.55	$1.86
Percent	9.36	6.80	7.50	7.08	7.84	9.96	8.09	9.03	9.4	8.0	8.23
Biometry	------	------	------	------	------	------	$0.008	$0.005	$0.018	------	$0.01
Percent	------	------	------	------	------	------	0.10	0.06	0.1	------	0.03
Biochemistry	------	$0.006	$0.058	$0.270	$0.237	$0.337	$0.201	$0.259	$0.764	$0.58	$0.56
Percent	------	0.16	1.31	5.61	4.61	4.93	2.60	3.03	4.2	3.0	2.48
Biophysics	$0.065	$0.098	$0.125	$0.165	$0.154	$0.096	$0.139	$0.118	$0.236	$0.39	$0.35
Percent	4.34	2.48	2.82	3.44	2.98	1.40	1.80	1.38	1.3	2.0	1.57
Embryology	------	$0.005	$0.010	$0.012	$0.005	$0.025	$0.055	$0.040	$0.109	$0.14	$0.13
Percent	------	0.14	0.23	0.25	0.10	0.37	0.71	0.47	0.6	0.7	0.57
Endocrinology	$0.091	$0.203	$0.290	$0.163	$0.183	$0.242	$0.360	$0.428	$0.746	$0.74	$0.77
Percent	6.08	5.11	6.56	3.40	3.56	3.53	4.64	5.02	4.1	3.8	3.41

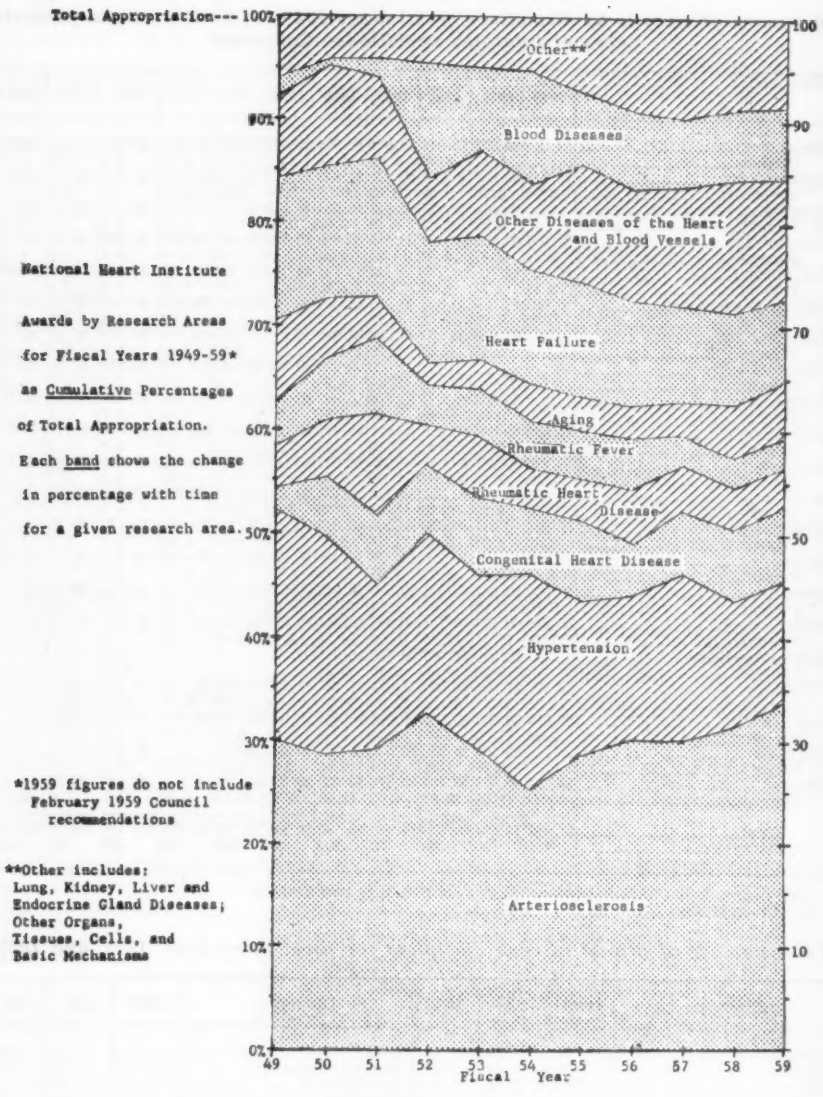
Summary of awards by disciplines, fiscal years 1949–59, in dollars and percentages of total appropriations—Continued

	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959 [1]
Enzymology	------	$0.035	$0.044	$0.071	$0.074	$0.097	$0.127	$0.185	$0.400	$0.43	$0.32
Percent	------	0.87	0.99	1.48	1.43	1.42	1.64	2.17	2.2	2.2	1.40
Epidemiology	$0.031	$0.031	$0.206	$0.029	$0.029	$0.055	$0.088	$0.061	$0.346	$0.45	$0.85
Percent	2.05	0.78	0.59	0.62	0.57	0.81	1.13	0.72	1.9	2.3	3.76
Genetics	------	$0.013	$0.027	$0.023	$0.031	$0.016	$0.022	$0.029	$0.091	$0.17	$0.19
Percent	------	0.32	0.62	0.49	0.62	0.24	0.29	0.34	0.5	0.9	0.88
Hematology	$0.034	$0.082	$0.281	$0.540	$0.480	$0.796	$0.660	$0.921	$1.528	$1.82	$1.96
Percent	2.31	2.07	6.36	11.22	9.31	11.63	8.52	10.80	8.4	9.4	8.66
Immunology	$0.038	$0.108	$0.179	$0.124	$0.144	$0.192	$0.295	$0.287	$0.327	$0.46	$0.52
Percent	2.58	2.73	4.04	2.57	2.80	2.81	3.80	3.36	1.8	2.4	2.31
Instruments-technics	$0.005	$0.033	$0.050	$0.037	$0.064	$0.099	$0.086	$0.085	$0.255	$0.15	$0.20
Percent	0.30	0.83	1.13	0.77	1.24	1.45	1.11	1.00	1.4	0.8	0.89
Mental health	------	$0.020	$0.025	$0.034	$0.019	------	$0.029	$0.051	$0.109	$0.08	$0.10
Percent	------	0.51	0.57	0.70	0.36	------	0.37	0.60	0.6	0.4	0.44
Microbiology	------	------	------	$0.020	$0.020	$0.061	$0.085	$0.113	$0.218	$0.21	$0.19
Percent	------	------	------	0.41	0.38	0.89	1.10	1.32	1.2	1.1	0.88
Morphology	------	$0.002	$0.021	$0.030	$0.047	$0.107	$0.081	$0.120	$0.309	$0.35	$0.31
Percent	------	0.06	0.48	0.63	0.91	1.57	1.05	1.41	1.7	1.8	1.37
Multidiscipline	$0.020	$0.019	$0.018	$0.009	$0.012	$0.071	$0.085	$0.154	$0.618	$0.79	$1.04
Percent	1.36	0.50	0.40	0.18	0.24	1.04	1.10	1.81	3.4	4.1	4.62
Neurology	$0.010	$0.046	$0.047	$0.045	$0.032	$0.045	$0.033	$0.037	$0.055	$0.04	$0.05
Percent	0.68	1.15	1.07	0.93	0.63	0.66	0.42	0.43	0.3	0.2	0.23
Nutrition	$0.098	$0.223	$0.195	$0.313	$0.174	$0.302	$0.291	$0.304	$0.582	$0.77	$0.94
Percent	6.59	5.62	4.42	6.51	3.38	4.42	3.75	3.56	3.2	4.0	4.15
Obstetrics-gynecology	$0.006	$0.011	$0.039	$0.065	$0.049	$0.125	$0.114	$0.126	$0.236	$0.23	$0.26
Percent	0.42	0.28	0.88	1.35	0.96	1.82	1.47	1.48	1.3	1.2	1.13
Pathology	$0.066	$0.218	$0.209	$0.257	$0.296	$0.359	$0.624	$0.665	$1.382	$1.55	$1.99
Percent	4.45	5.50	4.72	5.35	5.75	5.25	8.05	7.80	7.6	8.0	8.80
Pediatrics	$0.002	$0.037	$0.071	$0.049	$0.042	$0.045	$0.030	$0.050	$0.164	$0.19	$0.19
Percent	0.16	0.92	1.60	1.01	0.82	0.65	0.65	0.58	0.9	1.0	0.82
Pharmacology	$0.260	$0.777	$0.758	$0.495	$0.554	$0.584	$0.636	$0.671	$1.692	$1.09	$1.88
Percent	17.41	19.61	17.15	10.29	10.75	8.53	8.20	7.87	9.3	5.6	8.34
Physical medicine	------	$0.010	$0.007	$0.008	$0.015	------	------	------	$0.002	------	------
Percent	------	0.26	0.16	0.16	0.29	------	------	------	0.01	------	------
Physiology	$0.423	$1.035	$0.951	$1.034	$1.281	$1.692	$2.081	$2.120	$3.656	$4.34	$4.79
Percent	28.38	26.11	21.51	21.49	24.87	24.74	26.85	24.85	20.1	22.4	21.24
Public health	$0.036	$0.043	$0.083	$0.086	$0.082	$0.042	$0.076	$0.072	$0.255	$0.35	$0.38
Percent	2.43	1.09	1.87	1.78	1.59	0.61	0.98	0.84	1.4	1.8	1.70
Radiology	------	$0.106	$0.056	$0.050	$0.028	$0.025	$0.015	[2]	$0.036	$0.19	$0.08
Percent	------	2.67	1.27	1.04	0.55	0.36	0.20	0.01	0.2	1.0	0.37
Surgery	$0.155	$0.474	$0.469	$0.478	$0.600	$0.668	$0.785	$0.751	$2.146	$2.13	$2.47
Percent	10.39	11.95	10.62	9.93	11.64	9.77	10.13	8.80	11.8	11.0	10.94
Total	$1.491	$3.964	$4.420	$4.810	$5.150	$6.840	$7.750	$8.530	$18.190	$19.36	$22.57
Percent	100	100	100	100	100	100	100	100	100	100	100

[1] 1959 figures do not include recommendations of February 1959 Council.
[2] Less than $1,000.

Total number of grants in each discipline for fiscal years 1949, 1954, and 1959

Discipline	1949	1954	1959	Discipline	1949	1954	1959
Anesthesiology	1	10	12	Morphology	------	10	20
Biochemistry	6	43	122	Multidiscipline	2	5	25
Biometry	------	------	1	Neurology	1	4	4
Biophysical chemistry	------	14	33	Nutrition	6	18	48
Biophysics	7	12	25	Obstetrics-gynecology	2	13	23
Embryology	------	3	12	Pathology	7	38	121
Endocrinology	7	25	46	Pediatrics	1	4	13
Enzymology	------	10	26	Pharmacology	22	63	146
Epidemiology	1	3	34	Physical medicine	------	------	1
Genetics	------	2	7	Physiology	34	140	358
Hematology	4	55	132	Public Health	2	2	17
Immunology	5	15	31	Radiology	------	1	5
Instruments-technics	1	7	18	Surgery	13	52	162
Mental health	------	------	7				
Microbiology	------	3	9	Total	122	550	1,458



NATIONAL CANCER CHEMOTHERAPY PROGRAM

Senator HUMPHREY. If it had been feasible to enlarge this round-table conference still further, we would have been pleased to ask the other Directors of the National Institutes of Health to be present today. Since we already have more distinguished conferees than we have time for, it was not feasible for us to do so.

I do, however, want to insert in the record at this point a helpful memorandum on another phase of cooperation as demonstrated through another institute. I refer in this instance to the National Cancer Institute.

Back in March, we received at our request from Dr. J. R. Heller, who was then Director of the National Cancer Institute, a memoran-

dum on interinstitutional cooperation. It relates to one of the most significant research programs now underway, the national cancer chemotherapy program. The memo touches not merely on cooperation between Federal agencies, but between Federal and nonofficial organizations and institutions. This is real cooperation in action.

The memorandum will appear in the record at this point:

EXHIBIT 15

MEMORANDUM OF MARCH 15, 1960, FROM NATIONAL CANCER INSTITUTE ON VOLUNTARY COOPERATION IN NATIONAL CANCER CHEMOTHERAPY PROGRAM

NATIONAL INSTITUTES OF HEALTH,
Bethesda, Md., March 15, 1960.

DEAR MR. CAHN: In response to your request I have had the attached statement prepared, presenting the interinstitutional cooperation developed in our national program of cancer chemotherapy.

I hope that it will prove satisfactory for your needs.

Sincerely yours,

J. R. HELLER, M.D.,
Director, National Cancer Institute.

INTERINSTITUTIONAL COOPERATION IN THE NATIONAL CANCER CHEMOTHERAPY PROGRAM

Congressional interest in a national program of voluntary cooperative research in cancer chemotherapy led to the establishment of one of the largest, most comprehensive medical research efforts ever launched to find a solution to a single disease category. Emphasis was placed on promoting cooperation and integrating the efforts of scattered organizations and groups already engaged in some aspects of such a program.

The National Cancer Institute was given the responsibility for initiating this effort. To lay the groundwork for the interinstitutional teamwork necessary, a new advisory committee—the Cancer Chemotherapy Committee of the National Advisory Cancer Council—was established. At this time, the American Cancer Society and the Damon Runyon Memorial Fund for Cancer Research joined the National Cancer Institute as cosponsors of the program and named representatives to the Cancer Chemotherapy Committee. To promote a much larger and more highly integrated program, the following steps were taken: the establishment of a staff organization, the Cancer Chemotherapy National Service Center, to be responsible for the program; enlargment of the group of sponsors to include the Atomic Energy Commission, the Veterans' Administration, and the Food and Drug Administration; establishment of appropriate advisory committees; and creation of a contract program for the support of research and services to complement and round out the grants program in existence.

Because of the importance of coordinated effort among the sponsoring agencies, a top policymaking committee—the Cancer Chemotherapy National Committee—was created. Under its charter, the National Committee consists of a representative of each sponsor, plus a member from the pharmaceutical industry and a member-at-large. The sponsors are not bound by decisions of the national committee and each sponsor retains control of its own funds. Recognizing the vital role of industry in a drug-development program of this nature, an industry subcommittee was promptly established to give advice on the promotion of industrial participation.

The result of this coordination and focusing of effort is a highly integrated and cooperative scientific operation which insures complementary, rather than competing, research programs.

An outstanding example of the voluntary cooperative approach is found in the clinical area. The high degree of variability in the clinical course of different kinds of cancer and even in different individuals suffering from morphologically identical types of cancer makes it difficult to evaluate therapeutic regimens, especially in the testing of new drugs where response may at times be rather slight.

In order to move with speed and obtain a reasonably accurate measure of results, it is necessary to study large numbers of patients representing a variety of tumors under carefully controlled conditions. The Service Center has solved

this problem on a voluntary cooperative basis. Small groups of investigators selected on the bases of medical specialty, geographic location, and demonstrated interest are called together to explore the organization of a cooperative group. In this manner approximately 20 groups representing some 165 hospitals have been formed and are studying therapeutic regimens in about 7,700 patients. The Veterans' Administration hospitals are included among those participating actively in this phase of the program.

Another example of the voluntary cooperative approach is the setting up of retrospective and prospective statistical studies of the natural history of human cancer—untreated as well as treated by various modern methods. The ultimate test of any therapeutic regimen must be the effectiveness of its end results. To obtain information of this general nature is the objective of the end results study now going on under CCNSC auspices. The study is a voluntary cooperative program involving approximately 14 reporting institutions, Government and nongovernment. Under plans developed, each institution supplies punched cards for each cancer case to the CCNSC where the results are analyzed. From this study will emerge a picture of the response of various types of cancer to various forms of therapy.

Industrial participation in the program has assumed a position of major importance. Manufacturing drug, chemical, and allied firms are contributing to the overall program by supplying large numbers of materials for screening, carrying out primary and secondary operations, exploring the development of new, more effective screening techniques, conducting preclinical evaluations of promising materials, production of promising agents in sufficient quantities for clinical trial, and other activities vital to the program.

The Damon Runyon Memorial Fund supports research and training. The American Cancer Society supports research and training as well as lay and professional education in matters pertaining to cancer. Pharmacological and toxicological tests on promising drugs are carried out by the Food and Drug Administration. Facilities for the synthesis and evaluation of radioactive chemicals are provided by the Atomic Energy Commission.

Thusly, the large-scale National Cancer Chemotherapy research program has been launched in a relatively short time. Industry, Government, and academic institutions are working together with increasing effectiveness and enthusiasm. The underlying philosophy has been that necessary teamwork could be achieved on a voluntary basis. The importance of scientific freedom in academic institutions has been emphasized as essential for assuring originality and diversification. Industry has been encouraged to participate in a manner calculated to preserve the traditions of competitive free enterprise. Government has attempted to provide funds, services, stimulation, and an organizational framework in which cooperative research could develop. Whether the program will succeed from a scientific standpoint remains to be seen. It seems reasonable to conclude, however, that the underlying philosophy is sound and useful in organizing target research programs in the health field.

DEFENSE DEPARTMENT ORGANIZATION OF RESEARCH

Senator HUMPHREY. Dr. Cushing is here, is he not?

Dr. CUSHING. Yes, sir.

Senator HUMPHREY. You have now registered with the BSIE; is that right?

Dr. CUSHING. There is a little confusion, Senator Humphrey, as regards the organization of the Defense Department.

Senator HUMPHREY. Please explain.

Dr. CUSHING. I represent the health and medical side, which has no cognizance except in a few narrow fields of medical research. Medical research comes under Dr. York in Research and Development, and Colonel Talbot is the medical representative who has been kind enough to come with me today to try to give detailed information on the research side. So if you have any specific questions, I hope that you will direct them to him.

Senator HUMPHREY. We have Dr. Watt with us, and is it Colonel Talbot?

Colonel TALBOT. Yes, sir.

Senator HUMPHREY. Colonel, I suppose that the grant research projects that you have at the universities and other research establishments are registered with BSIE; is that correct?

Colonel TALBOT. That is right, Senator.

Senator HUMPHREY. Therefore, if anybody in NIH, in any one of the divisions, wanted to make a subject-type inquiry, it would be available on a moment's notice, so to speak, through the BSIE?

Colonel TALBOT. That is correct, sir.

NEW DEFENSE DEPARTMENT POLICY OF REGISTRATION

Senator HUMPHREY. Now we come down to the intramural research, where you are doing this in your own establishments, your own hospitals, your own research facilities. Have you registered those projects with BSIE?

Colonel TALBOT. These have been registered, Senator Humphrey, as you say, in response to your previous inquiry on this point.

Senator HUMPHREY. Had they been registered prior to that?

Colonel TALBOT. These had been registered in part prior to that, sir, on a voluntary basis from individual laboratories.

Senator HUMPHREY. But since the inquiry, now is it the uniform policy in the Department to register?

Colonel TALBOT. That is correct. The policy in the Office of the Secretary of Defense, specifically, the Office of Defense Research and Engineering, is to do this.

Senator HUMPHREY. There will appear now the text of the letter confirming future registration of Department of Defense intramural projects. I might mention that such registration was one of many points which had also been very soundly recommended by the distinguished group of consultants whom Senator Hill had appointed to report to the Senate Appropriations Subcommittee.

Dr. York's letter follows:

EXHIBIT 16

LETTER OF JULY 5, 1960, FROM DEPARTMENT OF DEFENSE CONFIRMING FULLER REGISTRATION OF RESEARCH PROJECTS WITH BIO-SCIENCES INFORMATION EXCHANGE

DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING,
Washington, D.C., July 5, 1960.

DEAR MR. CHAIRMAN: This letter is in response to your letter of June 3, 1960, concerning the practice of reporting of biomedical research projects to the Bio-Sciences Information Exchange, which has been forwarded to this office for reply.

In response to your first request for comments on the policy enunciated by the Jones committee and your subcommittee that all nonclassified biomedical projects should be registered with the BSIE, this Department is in agreement.

Defense Department agencies, which are engaged in grant and contract programs of major scope, for which there is likelihood of overlap between Defense agencies and with the programs of other Federal agencies, at present register all appropriate projects directly with BSIE.

The remaining Defense agencies and laboratories whose projects are largely conducted intramurally or by means of contracts undertaken as specific extensions of intramural effort have heretofore been registering such projects with BSIE on a voluntary basis where they can see benefit from this procedure.

In view of the importance attached to complete registration of Defense Department projects with BSIE by your subcommittee, this office has taken steps to register all research projects of all Defense Department components in the biological, medical, and psychological sciences with the exchange immediately. It is anticipated that this action will be completed by July 11, 1960.

* * * * * * *

Sincerely yours,

J. B. MACAULEY,
Deputy Director
(For Herbert F. York).

SUBCOMMITTEE STUDY OF PHYSICAL SCIENCES

Senator HUMPHREY. We are very appreciative of cooperation from the Department of Defense. I emphasize this fact because virtually simultaneously with our study of what the Department is doing in the life sciences, the subcommittee is also studying its much larger information program as regards the physical sciences.

In other words, we are looking at how to disseminate—through the Armed Services Technical Information Agency, the Office of Technical Services of the Department of Commerce, and other means—data on the 95 percent (or lower) research figure to which Dr. Shannon earlier referred in his testimony.

Naturally, the primary mission of the Department is the national security. That requires basically development and training in weapons systems. Accordingly, we have conveyed many requests to Dr. York's office for information as regards its predominant research in the physical sciences.

THE GOAL OF RESEARCH: INFORMATION

Let me elaborate now on this point about the information problem. In the work of our subcommittee in both the life sciences and the physical sciences, we have often been somewhat astonished to hear that some scientists dismiss the information problem as if it were a minor matter. (I am not referring here to the Department of Defense or to any other single agency's view.)

Let me say by way of contrast that the very purpose of research is to develop information. A scientist may work 2, 3, 5, or 10 or more years, and the entire result of his effort may be in the form of a single article in a technical journal. In other words, years and years of diligent effort wind up as a piece of information—a paper.

The paramount question heretofore has been, "What happens to that paper after it is published?"

Now we have extended the question. We have become still more mindful of the dimension of time. We are now asking, "What is happening as regards information during all those years before the paper is ever written?" If the entire goal of research is to add to man's knowledge, then why cannot we take steps to maximize man's knowledge while the research is still in process.

THE CRUCIAL FACTOR OF TIME

The time factor is crucial. We must constantly bear in mind that from the date a research project commences to the date it may be written up in a medical journal, a period of 2, 3, 4, or more years may

elapse. During that time other work related to the same subject may be commenced elsewhere. Scientists who might have benefited in the interim by communicating with one another may not, however, become informed that a related project existed until a particular paper appears, perhaps 4 years later. It appears sound, therefore, to do anything which we can do to increase the possibility of scientists being able to contact one another so as to exchange ideas long before a paper appears, if it ever does.

That does not, of course, mean jumping to premature conclusions as to possible results. It does not mean that assuming, because a scientist started on one research track, he is going to remain in the same track. Very often, exactly the contrary occurs. But it does mean having some systematic method whereby at least information about the very existence of a project can be and is communicated to others who might be interested in it.

IMPORTANCE OF VISITS AND CONFERENCES

In our interest in written information, for example, in a project summary on paper, we do not for one moment underestimate the value of personal visits, correspondence, meetings. On the contrary, we feel that an information exchange is an invaluable mechanism in setting up a meeting by first finding out exactly who to contact for participation. Thus, if an information exchange is complete and is properly consulted, individuals can be invited to attend the conference, not merely on the basis of what they wrote 5 or 6 years ago, but on the basis of what they are doing right now. In that way the value of the conference can be enhanced manifold.

SUPPLEMENTARY LETTER FROM DEPARTMENT OF DEFENSE

Now, to conclude this portion, in response to our subcommittee's invitation for supplementary comments by the Department of Defense on its work in the life sciences, there will appear in the record at this point an additional letter we anticipate receiving from the Office of the Director of Defense Research and Engineering on interagency coordination.

The letter follows:

EXHIBIT 17

LETTER OF SEPTEMBER 27, 1960, FROM DEPARTMENT OF DEFENSE SUPPLEMENTING TESTIMONY AT HEARING ON INTERAGENCY COORDINATION

DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING,
Washington, D.C., September 27, 1960.

DEAR MR. CHAIRMAN: Reference is made to the August 11, 1960, subcommittee hearing on the coordination of agency activities in biomedical research at which the Department of Defense was represented by Dr. E. H. Cushing and Col. J. M. Talbot; and to your request during the hearing for a summary statement of the views of the several witness agencies on this problem. For convenience, the subject may be divided into coordination within the Department of Defense and coordination among the various Government agencies.

Coordination within the Department of Defense is the subject of continuous study by this Office as well as the three military Departments. While it is apparent that there is room for some improvement, it is nevertheless considered that coordination within the Department of Defense is good. Some of the mechanisms for accomplishing this function are discussed in the succeeding paragraphs.

The Office of the Director of Defense Research and Engineering is responsible to the Secretary of Defense for coordination of all research, development, test, and evaluation programs of the three military Departments and the Advanced Research Projects Agency. This is a large part of the daily activity of the 223 scientific and administrative personnel of the ODDR and E and of the corresponding offices in the three military Departments. The ODDR and E is aided in this effort by a number of advisory groups, the principal of which is the Defense Science Board whose membership includes outstanding authorities for all major scientific and technical areas of importance to national defense.

The Advisory Panel on Medical Sciences is the main civilian scientific advisory group which assists the Director of Defense Research and Engineering in the biochemical sciences areas. The chairman of this panel is an ex-officio member of the Defense Science Board.

An internal group serving the Director of Defense Research and Engineering, known as the Coordinating Committee on Science, is made up of military and civilian members of the three military services and the Office of the Secretary of Defense; supporting it are coordinating representatives from each of the three services in the several basic research areas of importance to the Department of Defense including representatives for biology and medicine. Each of the military Departments has a top level scientific advisory body whose membership, as in the groups mentioned above, includes authorities in the biological and medical sciences. These bodies are the Air Force Scientific Advisory Board, the Army Scientific Advisory Panel and the Naval Research Advisory Committee.

Among the most important interservice agencies for coordination and exchange of research program information are the several committees of the National Academy of Sciences-National Research Council Division of Medical Sciences. Two of these are special committees devoted to the coordination of Armed Forces biomedical research; they are the Armed Forces-National Research Council Committees on Vision and on Hearing and Bioacoustics.

In addition to the above-mentioned activities, a most important part of coordination and the exchange of information involves continuous informal contacts among laboratory scientists, both intraservice and interservice, and with other Federal and civilian scientific groups. This is accomplished by a variety of methods, including letters, telephone, laboratory visits, conferences and symposia. It is augmented by the periodic major conferences of the national professional scientific societies whose membership includes many scientists from the Armed Forces. Some of the important ones for the biomedical sciences are the Aerospace Medical Association, the Federation of American Societies for Experimental Biology, and the American Institute of Biological Sciences.

With regard to coordination among the various Government agencies, it is believed that while certain parts of the Department of Defense programs are of interest to other agencies and vice versa, interagency coordination should be highly selective in order to prevent unwarranted waste of time and energy of our responsible research scientists and managers. At the present time, the three Federal agencies considered the most important for coordination with the Department of Defense in biomedical research are the National Aeronautics and Space Administration, the Atomic Energy Commission, and the National Institutes of Health. Adequate means now exist to effect this coordination, as will be briefly mentioned. Other Federal agencies with which more restrictive, selective coordination is and should be accomplished include the Federal Aviation Agency and the Veterans' Administration. To a lesser degree, coordination principally in terms of information exchange is done with the Department of Agriculture, the Department of State, and other Federal agencies.

Liaison officers provide an important channel for interagency coordination. For example, the military services have a group of officers, including biomedical specialists, assigned full time with the Atomic Energy Commission. Each service has scientists working full time with the NASA. The Assistant Secretary of Defense (Health and Medical) and the three surgeons general designate medical specialists to serve part-time with the research advisory councils and study sections of U.S. Public Health Service. The Assistant Secretary of Defense (Health and Medical) is a member of the President's Federal Radiation Council, and chairman of both the Interdepartmental Committee on Nutrition for National Defense and the recently formalized Interdepartmental Committee on National Blood Program Research.

With further reference to interagency coordination, one of the benefits of joint civilian-military membership in the several scientific advisory groups

mentioned above is the resultant opportunity for dissemination of program information through the civilian members who represent the Nation's universities, private research groups, and industrial research groups.

The daily informal coordinating activities of defense research managers and laboratory scientists communicate information to and from other Federal agencies and the civilian scientific community and utilize a number of different communications techniques. For unclassified research and development material, the scientific and technical journals and the public news media provide a continuing body of useful and timely information concerning activites in military research and development. In addition, the President's Scientific Advisory Council has become increasingly active in recent months in reviewing and evaluating the biomedical research programs of the Federal Government, including those of the Department of Defense.

Of fundamental importance to both interagency and internal Department of Defense coordination is the Bio-Sciences Information Exchange, which is supported in part by the Department of Defense. As was pointed out in the referenced subcommittee hearing, it is the policy of this Department to cooperate with the exchange at all levels of research activty, both for extramural and intramural programs.

It is hoped that the above summary will be useful to the subcommittee; we should be pleased to furnish additional information on details if this should be desired.

Sincerely yours,

J. B. MACAULEY, *Deputy Director.*
(For John H. Rubel, Acting).

DEPARTMENT OF AGRICULTURE DISCUSSIONS WITH BSIE

Senator HUMPHREY. I am just picking and choosing now among our witnesses. We are going back to our friend from the Department of Agriculture. That is Dr. Irving.

Let me ask again—Is it the policy of the Department of Agriculture to register your intramural research efforts with BSIE?

Dr. IRVING. It is not.

Senator HUMPHREY. When are you going to make it that?

Dr. IRVING. I hope we can resolve this problem fairly soon. We have met with the Bio-Sciences Information Exchange and representatives of other agencies on this matter within the past several months. The matter of the Department of Agriculture contributing to the exchange is under active consideration in the department. I cannot estimate how long it will be before we do, but I think it will be soon.

FEW AGRICULTURE DEPARTMENT SUBJECT-REQUESTS TO BSIE

Senator HUMPHREY. How many projects, research projects, do you say the Department of Agriculture has?

Dr. IRVING. Of intramural projects, about 3,000 total, with some 300 medically related.

Senator HUMPHREY. Last year your inquiries to the BSIE totaled only four.

Now, we always get requests for additional research funds up here in the Congress and I want you to know I have been one of your most ardent supporters for that. But it may be that a lot of overlapping research is going on and I did not even know it—not that that would be such a tragic development. But if the majority of the Congress did not know of it, it would lend itself to less than good management. I do hope that this Agriculture policy will be carefully reviewed. I think it should be, and that is the purpose of our meeting here: to find out if this seems to be a feasible approach, and if it is,

those of you who have the responsibility and who fulfill it well in your own respective jurisdictions should see if we cannot implement this kind of coordination.

FACTORS DETERMINING AGRICULTURE DEPARTMENT DECISION

The National Science Foundation representative is Dr. Wilson. Excuse me. Senator Muskie.

Senator MUSKIE. In the suggestion of problems concerning the implementation of this policy, what are the problems? Is there a possibility that you will decide not to register with BSIE?

Dr. IRVING. I expect we would have to recognize there is always that possibility. I think the direction in which we are going now is that we will. It is more a question of how soon rather than whether or not we will.

Senator MUSKIE. What are the considerations that are involved that might lead to a negative result?

Dr. IRVING. I think it would hinge to a great extent on how uniformly biosciences information is recorded in the Exchange. In other words, if this is to be an exhaustive compilation, as the Exchange would like it to be, of all bioscience information, then it would be infinitely more valuable to all participants and others than if there are gaps.

We would find it in Agriculture more usable as a tool in research administration and coordination if there were no gaps. We would not wish to be the sole gap in the complete registration of information in the Exchange.

Senator MUSKIE. Your participation depends upon the degree of participation by other agencies involved?

Dr. IRVING. I think it is a question for mutual consideration by all agencies, with their particular problems, of the value of this Exchange to them in the administration of their research programs. We, perhaps, have not felt as keen a need for this in administration of our programs as some of the other agencies. As has been mentioned earlier, we have not grown quite as rapidly as some other agencies.

DIFFERENT BASIS OF EXTRAMURAL GRANTS

Certainly, we have not grown as rapidly in extramural program responsibilities as have other agencies. The extramural program that we have in the Department of Agriculture is also different qualitatively from that which exists in the National Institutes of Health and some other agencies. We do not grant funds in the same manner that these agencies do. We grant by formula established in the authorizations of the Department of Agriculture to the State experiment stations, so that we have had a problem of a different order of magnitude and one that differs qualitatively from other agencies.

We recognize, though, that there is going to be an increasing overlap in the fringe areas of the missions of various agencies and that for that reason we want to use every practicable device to make our programs the strongest possible for agriculture and make them contribute in the strongest possible way to the missions of other agencies where there is overlap in the fringe areas between them.

I think that is our philosophy, and I believe in answer to your initial question, Senator, that we will eventually, and I think that will be soon, participate in the Bio-Sciences Information Exchange for both our intramural and extramural programs.

Senator MUSKIE. One further question: Did I detect in your earlier comments an implicit criticism of the form in which this information is available to BSIE at the present time?

Dr. IRVING. No. I intended no criticism of BSIE and the procedures that it has followed, the information and the form in which it is made available, no criticism whatsoever.

Senator MUSKIE. The form in which it is now available is a form which would be useful to you if you decide to participate in it?

Dr. IRVING. It would be.

MEMORANDUMS FROM DEPARTMENT OF AGRICULTURE

Senator HUMPHREY. There will now appear in the transcript some of the USDA materials furnished at our request.

The initial item consists of a series of memorandums compiled in November 1959 by the Department in response to our inquiry of its various divisions as to the relationship of their particular research to human health.

These memorandums are reprinted in some length because I believe that they point up relationships—both direct and indirect—which should become more familiar to both the legislative and executive branches, rather than only to professionals in the field.

The memorandums are not reprinted in entirety; selections have been made. I may say, too, that these memorandums were compiled over a relatively brief period of time for our prompt use last year; so they are not intended as definitive statements.

To me, the memorandums point up the fact that there must continue to be the strongest possible voluntary collaboration and the freest flow of communication between the Department of Agriculture and other agencies. And there must be systematic means whereby information can be stored, indexed, and retrieved for active utilization among all the agencies. A research finding which is "wheat," so to speak, to one agency may be "chaff" to another, and vice versa. That is, so-called byproduct of one study may become the very heart of another agency's study, if it can systematically learn about it in the first place. Such use should not be left to chance. Happenstance will always play a role but hardly should be relied upon in an age when electronic data processing mthods, in particular, provide such important opportunities for systematic collation.

Mr. Kenneth Haines of the Agricultural Research Service and his associates have provided these memorandums and a great deal of other useful information for us.

One segment of such information will appear in our forthcoming committee print entitled "Veterinary Medical Research and Human Health."

A matter of direct interest to human health is the exhibit which follows the memorandums. It is a chart on Department of Agriculture research in connection with cardiovascular problems.

ESTIMATES ON PROJECTS RELATING TO HUMAN HEALTH

Thereafter appear additional exhibits including precise statistical estimates as to the number of USDA-supported projects and their dollar volume in subjects having a direct impact on human health.

As a member of the Senate Committee on Agriculture I have had the opportunity, down through the years, to work closely with the Department. I cannot emphasize too strongly how deeply I regard the importance of its nutrition research, as well as the many other types of research which its long tradition of scientific study makes it especially well qualified to handle.

Let me note this fact: Never before, to my knowledge, has Department of Agriculture information as to the extent of its medically oriented research been available to the Congress in this manner. In fact, never before, to my knowledge, has the Executive branch compiled such data and made it generally available. In its various helpful analyses of Governmentwide biomedical research, the National Institutes of Health, for example, has not included any figures for or from the Department of Agriculture. Footnotes to NIH-prepared summaries as to the Governmentwide commitment usually indicate that NIH tables have been limited to data which has been "specifically identified" as medically oriented. This data is now, for the first time, available and is clearly identified. I, for one, believe that this type of USDA information should be included henceforth in all Governmentwide analyses.

It is not that I am interested only in getting an accurate and complete statistical picture for the Congress; it is that, far more important, I want this to be a first step in making sure that information on the actual scientific work under support by the Department of Agriculture is made available in fullest form to other Federal agencies.

There follow several of our past as well as future letters with the Department.

EXHIBIT 18

ILLUSTRATIONS OF USDA-SUPPORTED RESEARCH OF SIGNIFICANCE TO HUMAN HEALTH

MEMORANDA OF NOVEMBER 1959 FROM U.S. DEPARTMENT OF AGRICULTURE DESCRIBING HUMAN NUTRITION RESEARCH AS A PHASE OF BIOCHEMICAL RESEARCH

Accomplishments

In 1894 Congress appropriated a special fund to initiate nutrition investigations in the Department of Agriculture. Through the Department's Office of Experiment Stations, the help of many agricultural experiment stations and colleges throughout the country was enlisted in conducting dietary studies and digestion experiments, using human subjects and animals, and in determining the composition and calorie values of foods. These investigations, now classic, were continued until 1915.

Food analyses from the above studies, and many more conducted at the Connecticut station, were assembled in 1896 in the first compilation on the "Composition of American Food Materials." Last revised in 1906, and finally out of print in 1940, these tables served as a standard reference on the protein, fat, carbohydrate and ash content, and the calorie values of foods.

The human respiration calorimeter, perfected in the 1880's, was available in 1894 for determination of human energy (calorie) requirements. Used first at the Connecticut station and later transferred to the Department of Agriculture, the calorimeter was used until 1923 in determining energy requirements of human subjects (chiefly men and women) conducting various types of activities. Basic data from these experiments, and other considerations, are reflected in current recommendations for human calorie allowances.

Mottled enamel was produced experimentally in rats (Arizona, 1931) given drinking water taken from an area where this severe condition of the teeth was endemic. These results and other experiments, including analyses to show the high content of fluoride in the water supply of the area in question, provided conclusive evidence that excessive ingestion of fluoride is the cause of mottled enamel. This detrimental effect of high fluoride concentrations in drinking water is in contrast to the beneficial effect of low concentrations in reducing dental caries (Oregon, Washington, Idaho, Utah, Montana, 1947–58).

In a study of chick pellagra (Wisconsin, 1937) a substance isolated from potent liver extracts was identified as nicotinic acid. This compound proved effective in curing black tongue in dogs, a disease which in its symptoms appeared to be the counterpart of human pellegra, then under intensive study by Goldberger of the U.S. Public Health Service. Announcement of the discovery of this essential dietary factor resulted in subsequent establishment of its efficacy in the cure of human pellagra.

Research with rats (Illinois, 1930–38) established nine amino acids that were necessary for normal rate of growth. Experiments with young men showed that eight of these were essential to maintain nitrogen equilibrium. Recommended daily intakes of each of these amino acids for men was finally determined (1955).

Certain studies of amino acid requirements of women (Nebraska, Wisconsin, 1952–58) suggest that their requirements may be lower than those of men. On the other hand, experiments on requirements for lysine (Indiana, 1952–58) showed no sex differences and agreed with the Illinois findings above. Future research will resolve this apparent discrepancy.

Recent researches have provided evidence that the problem of establishing human requirements for protein, or for amino acids, is very complex, involving the interrelationships of nutrients in human metabolism and the availability of specific amino acids from foods. Some of the pertinent findings to date are as follows:

Calorie intakes must be adequate for retention of ingested protein nitrogen by the body (Wisconsin, Indiana, Nebraska, USDA).

Protein and energy utilization of equi-caloric diets were unaffected by different proportions of fat and carbohydrate in the diet. This indicated that dietary energy may be supplied equally well by fat or carbohydrate (Pennsylvania, 1958).

Indiana research (1957) suggested that feeding the intact food protein may elicit a different response than feeding equivalent mixtures of amino acids.

The recommended allowances for riboflavin is based upon the assumption that the metabolism of riboflavin and protein are interdependent. Studies with rats (New York, Cornell, 1958) have conformed a relationship but, with the criteria used, indicate that a deficiency level of either nutrient is necessary to significantly affect the metabolism of the other.

Findings with human subjects (Massachusetts, 1958) suggested that thiamine may be necessary for the most efficient conversion of tryptophan to niacin. Hence, both tryptophan and thiamine levels will need to be taken into account in setting dietary requirements for niacin.

Deficiency of the essential amino acids, tryptophan and methionine in the protein of pinto beans limits the nutritional quality of this food, economically important in the Southwest, as a source of protein. Small supplements of these amino acids, however, made good the pinto bean deficiencies in feeding trials with experiment of animals (New Mexico, 1958).

Studies with human subjects (Nebraska, 1957–58) have shown that both threonine and lysine, essential amino acids in corn protein, are "given up" to the body in the normal digestive process, and utilized as well as equivalent amounts of the purified amino acids.

Nutritional status investigations (1947–58), cooperative within and between stations in all four regions of the United States, involved the participation of 200 professional nutrition investigators in 39 experiment stations, with contributing services of the U.S. Department of Agriculture, the U.S. Public Health Service, and several State departments of public health. The findings on state of health in relation to nutrient intake are significant since observations were made on over 4,000 in each of the age groups representing children (under 13 years), adolescents (13–20 years), and adults (21–80 years).

Data from these surveys make a notable contribution to the mass of data accumulating, toward establishing, reaffirming or revising norms for height

and weight, by age and sex; for blood hemoglobin; blood cholesterol; and blood levels of vitamin A, carotene and ascorbic acid.

The data obtained will also be useful in future refinements of tables of dietary allowances (National Academy of Science, National Research Council). The nutritional status findings suggested, for example, that the current allowances for calcium and iron may be unduly high. Obesity observed in older women, yet associated with low calorie intakes, (Iowa) suggested that calorie requirements need to be reappraised for this population group.

On the whole, nutritional status of the population was found to be good by the standards of adequacy expressed in the National Research Council's recommended daily allowances of nutrients (1958). The diets of teenage girls, however, presented an unfavorable picture since intakes were adequate in only three nutrients and severely low or borderline low in all others.

The concentration of cholesterol in the blood has been of interest in recent years as a possible index of arteriosclerosis. The nutritional status investigations revealed that, in general, females at all ages had higher levels of blood cholesterol than did males, suggesting, especially, that separate norms need to be established for men and women. The establishment of normal range for age was unresolved, although, in general, serum cholesterol rose from young to older age groups.

Researches by 10 of the participating States, with an intensive study by five Western States, showed that dental caries was the most prevalent defect in schoolchildren. When all areas were considered, incidence was not related to diet or climatic factors, but was related to fluoride in the water supply. Fluoride content from 0.5 to 1.5 parts per million had a striking protective action against caries in native children. This supports earlier work (USPHS).

Current research

Relatively little information is available on the metabolism and utilization of nutrients by preschool children to serve as a basis for establishing their nutritional requirements. Metabolism experiments on girls 7 and 8 years of age were initiated, therefore, by southern regional endeavor in 1954 and repeated in 1956 and 1958. The series of highly controlled experiments, when completed with statistical analyses of the data, will contribute basic information on normal metabolism and protein needs. The findings will serve as a reliable basis for judging what is adequate food intake for girls of this age. In all, data are being collected on 62 nutrients—protein, fat, vitamins, and minerals, including trace elements, even strontium 90. Observations are also being made on several indices of nutritional well-being, such as bone density, red cell count, and hemoglobin concentration. Local physicians have served as consultants. Cooperators are the experiment stations of Georgia, Kentucky, Louisiana, Mississippi, Oklahoma, Tennessee, and Virginia; the USDA; and by contract, the Medical School of Tulane University.

Various aspects of protein, and amino acid, metabolism, and requirements continue to receive intensive attention in three of the cooperative researches.

Investigations among seven stations in the north-central region are being conducted to determine, for example, the influence of nonessential amino acids in the diet on requirements for essential amino acids, and on replacement values of cereal for animal protein or of different combinations of animal proteins for each other.

Three stations (Oregon, California, New Jersey) are concerned with the complex problem of determining the role of vitamin B_6 in protein metabolism.

In the northeast region, 7 of the 12 participating stations are working on some phase of the interrelationships between protein and fat in human metabolism. Both human subjects and experimental animals are being studied. The findings will be of significance not only for their bearing on protein requirements, but also for the light they will throw on the matter of fat metabolism and possible significance in the development of arteriosclerosis.

Representative data on the composition of many foods are included in current food composition tables (USDA), used for calculating the nutritive value of self-chosen diets of individuals or of population groups. Such tables are also needed in planning special diets, as for the diabetic or cardiac patient, or the person on a dietary regime for weight loss or gain. Basic data utilized in the preparation of these tables, covering nutrients currently known to be essential for good nutrition, are compiled from many sources. Experiment station re-

searches continue to provide many of the data, especially through investigations to reveal the influence on composition of factors operating from production through marketing, processing, and finally, home utilization. The following researches are illustrative:

Genetic and chemical studies to develop improved varieties of tomatoes of high vitamin C and provitamin A content (Indiana).

The protein and threonine content of shell eggs and content of certain amino acids in poultry meat are being studied with respect to age of hen, effect of storage, and effect of cooking (Indiana).

Other studies of the chemical changes in shell eggs during storage are concerned with changes in the content of vitamins (carotene, vitamin D, γ-tocopherol, vitamin K, ascorbic acid, and thiamine), lipids, and amino acids of the egg protein (Michigan).

The nicotinic acid, pantothenic acid, biotin, pyridoxine, and vitamin E content of the more important kinds of cheese is being investigated to determine the importance of cheese as a dietary source of these vitamins. Other aspects of the research are concerned with the effect of changes in manufacturing and curing processes upon these vitamin values (Nebraska).

Normal levels of certain major and trace mineral elements in milk are being determined. Further investigations will determine whether these levels can be increased by feeding appropriate supplements (Massachusetts).

The sodium content of some important fruits and vegetables is being investigated with reference to the area where grown and especially with reference to proximity to the ocean (Hawaii).

The effects of cooking and of reheating on the vitamin content of meat are being determined (Minnesota).

Soybeans differ from other legumes in culinary qualities. Edible varieties of soybeans, fresh, frozen, and canned, are being analyzed for their content of fat and the carbohydrates pentosan and galactosan to determine whether these components are related to texture and culinary qualities (Illinois).

Because of the current high consumption of foods fried in deep fat at high temperatures, there is special interest in determining whether the high temperatures produce chemical changes in the fat, protein, and carbohydrate fractions of foods, and whether these changes are correlated with any changes in nutritive value. A study of the problem has been initiated (Illinois) with determinations of the biological utilization of fatty acid isomers and derivatives such as those resulting when fats are heated as in deep fat frying.

CONTRIBUTIONS BY THE ENTOMOLOGY RESEARCH DIVISION, U.S. DEPARTMENT OF AGRICULTURE, TO FEDERAL BIOMEDICAL RESEARCH

A. Specific Projects in Which the Department Has Aided Biomedical Research

1. *Research on methods for controlling insects of medical importance.*—In direct collaboration with the Department of Defense, and through informal collaboration with the U.S. Public Health Service and the Tennessee Valley Authority, research is conducted by the Entomology Research Division of the U.S. Department of Agriculture on the development of methods to control medically important insects. This work, which involves the search for and development of safe and effective insecticides and repellants for use against mosquitoes, mites, flies, ticks, fleas, and lice, has provided highly effective measures for reducing and preventing the diseases they transmit. For example, Department entomologists, chiefly at the Orlando, Fla., laboratory of the Entomology Research Division, supported by funds provided by the Armed Forces (1) conceived, planned, and demonstrated that insecticides such as DDT could control malaria by controlling the mosquito vectors with residual sprays in buildings. This led to the adoption of the method by the Public Health Service and the World Health Organization for use in national and worldwide malaria eradication programs; (2) developed effective body-louse powders which were used with such great success during World War II and in Korea that only a few cases of human typhus occurred, whereas during World War I the number of human military and civilian cases totaled hundreds of thousands; (3) developed insect repellants that protected thousands of Allied troops and civilians from highly fatal scrub typhus, a mite-borne disease. U.S. Department of Agriculture scientists were frequently assigned to assist medical au-

thorities with these problems in oversea areas. Hundreds of personnel of the Armed Forces, the U.S. Public Health Service, and other agencies concerned with health have been given formal and informal training by U.S. Department of Agriculture entomologists and chemists in problems concerning biology and control of mosquitoes, lice, fleas, and other insects vectors of human diseases.

2. *Development of purchase specifications for pesticides of military importance.*—To assist defense agencies in the procurement of standardized insecticides and insect repellants of medical importance, research is carried out by chemists of the Entomology Research Division, U.S. Department of Agriculture, in direct cooperation with the medical and procurement branches of the defense agencies through the Armed Forces Pest Control Board to develop specifications that are used by all Federal agencies and also serve as a basis for World Health Organization specifications. Specific examples of products for which such specifications have been developed include DDT louse powders, insecticide aerosols, and diethyltoluamide insect repellant.

3. *Development of ethylene oxide sterilant aerosols.*—Under contract with the Biological Warfare Laboratories of the Army Chemical Corps, efficient, nonflammable aerosol formulations of ethylene oxide have been developed by the Entomology Research Division, U.S. Department of Agriculture, for use as a sterilant and germicide, and purchase specifications have been prepared. These ethylene oxide aerosols are highly effective against pathogenic micro-organisms, including viruses, and can be used for the sterilization of materials that are sensitive to heat and ordinary chemical disinfectants. They will be useful to all biomedical agencies concerned with the control of pathogens.

4. *Development of formaldehyde disinfectant aerosols.*—Under a transfer of funds from the Department of the Navy, liquefied-gas-propelled aerosol formulations of formalin have been developed and automatic dispensing equipment has been designed by the Entomology Research Division, U.S. Department of Agriculture, for disinfection purposes. This method of disinfection will be especially useful in hospitals and laboratories where bacterial contamination may occur.

5. *Taxonomy of arthropods of medical importance.*—The correct recognition of arthropods of medical importance is essential to any investigations on these organisms as vectors of diseases or as pests of man. Only painstaking research can lead to the development of quick, accurate methods for identifying important species. It is also essential to obtain and document for ready reference information on their biology, distribution, and pest relationships.

Taxonomists of the Entomology Research Division, U.S. Department of Agriculture, collaborate with specialists in the Army, Navy, National Institutes of Health, and U.S. Public Health Service in research on the collection and identification and studies on biology and distribution of insects and other arthropods of medical importance from all parts of the world. This has led to the preparation and publication of comprehensive and extremely useful keys, synoptic catalogs, monographs, technical bulletins, and handbooks on such important medical insects as mosquitoes, house flies, black flies, flies that cause myiasis, and lice. Research is also conducted on biting midges that transmit eastern equine encephalitis and human onchocerciasis, chiggers that transmit rickettsial disease, and mites that may be involved in transmission of hemorrhagic fever.

The taxonomists provide authentic identifications for many thousands of specimens of medically important arthropods from all parts of the world in rendering assistance to the Army, Navy, National Institutes of Health, and numerous other agencies concerned with biomedical problems. On occasion specialists have served as consultants with the Navy and Army on taxonomic problems in foreign areas. The U.S. Department of Agriculture taxonomists have provided specific training to Army and Navy malaria survey and control officers, especially during World War II, in identification of mosquitoes and their biologies, and assist many International Cooperation Administration trainees in learning how to recognize medically important insects.

B. Ways in Which Department Research Has Aided Federal Biomedical Research

1. *Irradiation as a means of insect control.*—Basic research on sterilization of insects with atomic energy and the release of sterile males to eradicate the screw worm, a serious pest of man and animals, first from the island of Curaçao and more recently from the southeastern United States, has suggested possibilities for the application of this method by various Federal biomedical agencies to control insect, rodent, and other important disease vectors.

2. *Systemic insecticides.*—USDA research leading to the development of systemic insecticides, presently used for controlling cattle grubs and other insects

affecting livestock, has suggested a possible new method for controlling the human bot fly, a pest of man in Central and South America. Associated studies on the metabolism of radioisotope-tagged systemic insecticides in laboratory animals and cattle have provided much basic information applicable to human physiology and toxicology.

3. *Cancer screening program.*—Samples of organic compounds synthesized for screening as insect attractants or repellants, insecticides, or synergists are supplied to the National Institutes of Health for screening as anticarcinogenic agents. Over 2,000 of these compounds have been furnished them thus far, and several have been of sufficient interest for more extensive testing by the Institutes.

4. *Aircraft disinsectization.*—Interchange of information and plans is maintained and from time to time experiments are carried out jointly with the U.S. Public Health Service and the Military Air Transport Service on formulations and equipment for the disinsectization of aircraft to prevent the introduction into the United States of insect vectors of disease.

5. *Analytical methods.*—Methods of analysis developed by chemists of the Entomology Research Division, U.S. Department of Agriculture, for minute amounts of pesticides and their metabolites in animal tissues, milk, foods, etc., are used by other Federal agencies and generally throughout the world in connection with toxicological and physiological research. An outstanding example is the Schecter-Haller colorimetric method for DDT.

6. *Insecticide residue data.*—Data on residues of insecticides and related materials obtained by the Entomology Research Division of the U.S. Department of Agriculture are useful to the Food and Drug Administration and to the U.S. Public Health Service in establishing safe tolerance levels in foods and feed and in determining the safety of materials for application to man.

7. *Liquefied-gas aerosols.*—The principle of liquefied-gas aerosol formulations and dispensers, originally devised by the Entomology Research Division, U.S. Department of Agriculture, for dispersal of insecticides has been utilized by medical agencies for the dispensing of such items as medicaments, antiseptics, and anesthetics.

8. *Antibiotics from bee disease organisms.*—An antibiotic isolated by the Entomology Research Division, U.S. Department of Agriculture, from *B. larvae*, causative organism of American foulbrood, showed an inhibition spectrum against a wide range of organisms including typhoid bacillus and the human tubercle bacillus. This antibiotic possessed certain physical and chemical properties, some of them differing favorably from penicillin, that would possibly make it valuable in human or animal therapy. Of four antibiotic agents produced by *B. larvae* and separated by chemical means, one active against a strain of tubercle bacillus *in vitro* could be isolated in a relatively nontoxic state. A patent was issued on "the process of preparing an antibiotic substance from *Bacillus larvae*." Under informal agreement, a study of this American foulbrood antibiotic was carried out at the National Institutes of Health, and its activity against known pathogenic strains of the human tubercle bacillus was established.

9. *Sterol metabolism.*—The research by physiologists of the Entomology Research Division, U.S. Department of Agriculture, on sterol metabolism in insects and the role of this biologically important group of chemicals is yielding information that will be important to many areas of biomedical research. The insect requires an exogenous source of sterol for growth, metamorphosis, and reproduction, and appears to be incapable of sterol biosynthesis, thus the insect is the optimum biological system for studying the role of neutral sterols in the biochemical economy. This problem would be difficult to resolve in mammals because of their high rate of endogenous sterol biosynthesis. Information obtained will have a bearing on such important problems as atherosclerosis and provitamin D synthesis. The results of experimentation and its significance have been discussed informally with various specialists at the National Institutes of Health.

10. *Antimetabolites affect growth.*—The Entomology Research Division, U.S. Department of Agriculture, has cooperated informally with the National Institutes of Health to determine the effects of antimetabolites on insect growth. Since the inhibition of growth is basic to both cancer research and the induction of sexual sterility in the insect, the same growth-inhibiting chemicals are used for experimental purposes. The Cancer Chemotherapy Coordination Center of the National Institutes of Health has provided many of the chemicals used by U.S. Department of Agriculture entomologists to induce sterility. This work was the basis for a rapid inexpensive method for screening anti-tumor drugs

using an insect—data recently published in Cancer Research. Many of these chemicals inhibit the synthesis of nucleic acids, and a study of these compounds is underway.

RELATIONSHIP OF PLANT PATHOLOGY TO BIOMEDICINE

Stanley purified and crystallized the tobacco mosaic virus (1935) and received the Nobel Prize for this work. The entire field of virology underwent a profound change after this discovery. The many papers on plant viruses clearly demonstrate the debt that the field of general virology owes to plant virus research.

In 1955 the first animal virus was crystallized (MEF–1 poliomyelitis virus). Research has shown that plant and animal viruses may be chemically and structurally similar.

Techniques for the more precise study of the structure of plant viruses have been developed at the Universities of California and Wisconsin.

The biochemistry and biological activity of plant viruses are being studied at Missouri, Nebraska, and Utah.

Research on the role and occurrence of noninfectious proteins in virus synthesis is in progress at the California station; the interaction of several viruses in the plant cell is being studied at the New York station and Rockefeller Institute; and the relationships between viruses with serological methods at the Nebraska and Wisconsin stations.

Work at Illinois and Wisconsin has shown that viruses cause tumors in plant parts and the medical people have demonstrated that viruses cause tumors in animals and humans.

Fundamenal research at the Maryland station by plant pathologists on mitochondria showed the relationship of these bodies to cancerous tissues and both workers are now employed at the National Institutes of Health in cancer research.

All of these studies may help to better understand the biology of viruses that attack animals and humans.

Genetics of micro-organisms.—Research at the Louisiana, Minnesota, and Wisconsin stations have conclusively demonstrated the cause of variation in micro-organisms and showed differences in pathogenicity of organisms. California and the above station have demonstrated on numerous occasions how new strains of organisms arise and these studies have provided a tool for better understanding of plant, animal, and human genetics.

A worker at the Wisconsin station received the Nobel Prize in 1958 for his research in the genetics of micro-organisms.

Antibiotics.—The ability of soil fungi to inhibit the growth of other fungi and bacteria and to bring about their destruction has been known for many years and was first discovered by Dr. S. A. Waksman and R. L. Starkey at the New Jersey station in 1923. Through their ability to produce such agents, fungi are playing an important role in controlling a variety of infections in man and in animals. Later S. A. Waksman of the New Jersey station received the Nobel Prize for his discovery of streptomycin.

The work of R. Weindling at the California station at Riverside on *Trichoderma lignorum* as a parasite of other soil fungi was a classic and is considered by many to be of more fundamental importance than Fleming's report of the discovery of penicillin. For example, S. D. Garrett in England states, "this work of Weindling's can now be seen as an outstanding monographic study which has inspired many subsequent investigations." Weindling's research culminated in the isolation of two potent antifungal antibiotics, gliotoxin, (Weindling and Emerson 1936) and viridin (Brian and McGowan 1945). Weindling is now employed by the Lederle Laboratories where he is working on the development of antibiotics for medicinal use. Many experiment station workers are looking for antibiotics which will be effective against fungi bacteria and/or nematodes. Some of these antibiotics may also be of considerable value in the control of human diseases.

Many stations are involved in testing new fungicides that are safe and non-
Some of these antibiotics may also be of considerable value in the control of
that the end product will be attractive and nutritious.

Micro-organisms are widely used in the commercial production of chemicals. Recently the Schering Corp. employed a microbiologist who received his doctorate in the Department of Microbiology at the New Jersey station. His assignment was to develop a method for the production of certain steroid chemicals through the use of micro-organisms. He was successful in finding an organism that

would produce this particular steroid, and a multimillion-dollar industry has been developed from his work. This steroid is widely used by the medical profession in the treatment of arthritis.

SOCIOLOGICAL CONTRIBUTIONS TO RURAL HEALTH

Interest in the sociological aspects of rural health and the health institutions and services has grown steadily. Most of the early studies were largely descriptive and informational. More recent studies have sought to make the public aware of the need for reducing deficiencies of rural medical service. Some of the earlier studies were influential in the legislative provision for county public health units in the Federal Security Act of 1935. These and later studies helped provide information leading to provisions for assistance to communities for hospital construction in the Hill-Burton Act of 1946.

Among the early studies was one (New York 1928) which investigated the effects of illness on the farm family's social and economic life and the adequacy of rural medical service. Similar studies followed (Oklahoma 1931, South Dakota 1931, Arkansas 1938, Ohio 1944, Missouri 1945, Missouri 1947, Ohio 1949, Mississippi 1950, Indiana 1952, Missouri 1952.)

The high proportion of rural and especially farm youth rejected during World War II and during the Korean War focused attention on the rural health situation and its problems. A number of State colleges of agriculture conducted studies aimed at determining health needs and health care, health resources available, and their use by rural people (North Carolina 1946, Missouri 1947, New York 1948, Ohio 1949, Michigan 1950, Louisiana 1954). Still other studies were quite detailed, exploring not only the number and distribution of health personnel, services, and facilities, but also the proportion of rural people who had family physicians; who had various forms of immunization and X-rays; who had wells inspected; and who practiced various forms of sanitation. Incidence of illness was measured. Hospital experience was determined. Knowledge of acceptable health practices and health facilities was determined. Folk medical practices and their extent were studied. The following lists studies covering one or more of the foregoing items (Ohio 1941, North Carolina 1944, Ohio 1944, North Dakota 1945, Ohio 1945, Virginia 1945, Montana 1946, North Carolina 1946, Missouri 1949, Pennsylvania 1949, North Carolina 1950, Michigan 1951, New York 1952, Missouri 1953, Mississippi 1954, Nebraska 1954, Oklahoma 1955).

Current studies are concerned with trends in health needs, facilities and practices of rural people (North Carolina 1955, Kentucky 1956, New York 1958); with determining the role of cultural factors on health and health practices in selected rural areas (Missouri 1954); with utilization of health services by rural people (New York 1958); and with ascertaining the nature and extent of effective methods of community organization to successfully attain health goals including health facilities and health personnel (Michigan 1946, North Carolina 1955).

From these studies several conclusions have emerged. Types of problems which must be attacked in improving rural health are pointed out. Level of living, education, and social and economic conditions largely determine variations in rural health. Loss of time from productive work is a serious drain in the rural popuiation. Lack of information and cultural factors play an important part in the low demand for proper health care. There appears to be a rather consistent decline in number and quality of health personnel in rural areas.

FOOD AND DAIRY TECHNOLOGY RESEARCH RELATED TO BIOMEDICAL RESEARCH

Accomplishments

Early research, conducted by the first dairy bacteriologists (Connecticut, Illinois, and Wisconsin) demonstrated living organisms in the contents of spoiled cans of foods and showed the spoilage of canned foods to be due to certain spore-forming bacteria known as thermophiles. This work helped establish the scientific basis for sterilization of canned food products which is so important to human welfare today.

Experimentation at Wisconsin led to the discovery that certain sterol fractions of foodstuffs could be converted to vitamin D by irradiation with ultraviolet light. Since milk is so important to the diet, subsequent development and application of this process to milk became a great benefaction to all mankind.

Current

Strontium 90 tends to react chemically like calcium. The level of Sr^{90} in milk is of concern since milk and milk products supply about 80 percent of the calcium in the American diet. Work underway at Tennessee indicates ion exchange methods will remove Sr^{90} from milk with but little effect upon the properties of the milk. Continued study and further development is necessary in the event radioactive fallout should become a problem.

Research is underway (USPHS, California) to determine the time and temperature factors in pasteurization which are necessary for the elimination of the Q-fever organism in milk and thus prevent disease transmission to man and animal.

The wholesomeness of food may be affected by processing techniques. Several current studies are being conducted (Illinois, Massachusetts, Wisconsin, and Michigan) to determine: the heat damage to the nutritive value of triglycerides; the rate of destruction of the heat-labile vitamins by high-temperature, short-time (250° to 300° F.) processing; and the effect of irradiation on the nutritive value by study of vitamin K deficiencies induced on feeding irradiated beef to animals. (USPHS support.)

Freeze-drying of meat is being studied (California). Development of foods which are very stable and store well is essential to preparedness in meeting emergency of disaster situations. (USPHS support.)

Application of ionizing radiation sterilization to foods and other materials led to study of the radio-resistance of micro-organisms. Station researchers (Oregon) demonstrated presence of a radio-resistant micrococcus in samples of ground beef and pork following gamma irradiation. Further work is underway to establish its source and habitat in nature. (Department of Defense support.)

State stations (Illinois, Massachusetts, Michigan, and Wisconsin) are accumulating basic data relating to the determination of the thermal resistance of vegetative cells, bacterial spores and viruses. Availability of reliable lethality data has led to applications in high-temperature short-time processing of milk and other food products. Safe, high quality, nutritious processed foods which have prolonged storage life are available to the public. Information of value relating to bacterial metabolism has wide application in the field of biology and medicine.

BIOMEDICAL RESEARCH IN THE TERRITORIAL EXPERIMENT STATIONS DIVISION, AGRICULTURAL RESEARCH SERVICE

A. Research cooperative with agencies other than in USDA

The Federal Experiment Station in Puerto Rico (FESPR) is currently engaged in a research project with scientists at Boston University working with the aid of a grant from National Institutes of Health. That agency has a broad research program, including investigating the sources and reaction of blood-typing substances in the seeds of plants. Tropical plants are being sought, studied, and indexed at the FESPR in the furtherance of a knowledge of blood agglutinins.

The Federal station in Puerto Rico has also served as headquarters for scientists, including plant explorers, who have made special studies of tropical botanical groups which have biomedical potentialities in influencing the human circulatory system.

Research on Cinchona from which quinine is derived was initiated at the Federal station in 1935. During World War II emergency work was instituted to strengthen the seriously disrupted supply of quinine for the treatment of malaria. Working cooperatively with the Defense Supplies Cooperation, and other agencies of the USDA, a stock of Cinchona plants was built up, high yielding strains selected and made available to other friendly countries in the Western Hemisphere.

B. Research cooperative with agencies within the USDA

Over a number of years the FESPR has conducted research with tropical plants from which steroidal sapogenins (cortisone precursors) can be obtained. This work is cooperative with the New Crops Research Branch of this service and several commercial interests. Research with *Strophanthus* and, more recently and intensely with *Dioscorea*, involving agronomic and chemical studies have been pursued to develop and select strains with a high yield of cortisone precursors for wide medical use.

Research at FESPR on insecticides from plant sources, which has included the genera *Derris* and *Lonchocarpus*, has been accelerated by the so-called Miller amendment to Public Law 518 of the 83d Congress. The danger to health from synthetic insecticide residues on edible plant products has directed greater interest in safer insecticides derived from plants. *Tephrosia vogelii* is now under study as a potential source of rotenone for insecticidal use. A program is underway studying the potentialities of this plant involving agronomic improvement, a search for high yielding strains, and hydridizing work, which is favorable under the tropical environment of Puerto Rico.

Another project at FESPR concerns the possible toxicity of tropical fruits. Fruit of *Mammea Americana* (mamey) are widely consumed in Puerto Rico both fresh and processed, despite the fact that certain parts of the plant contain a potent insecticide. The nature of the toxic substance and its effect on the organs of small animals are being investigated.

The Virgin Islands agricultural program on the island of St. Croix is currently making a study of poisonous plants that grow on the Virgin Islands. A phase of this work resulted in the publication in the Bulletin of the History of Medicine of an article prepared jointly with FESPR entitled "The West Indian Weedwoman of the United States Virgin Islands."

ANIMAL HUSBANDRY

Animal Husbandry Research Division studies suggested as related to the area of interest:

1. Collaboration with National Heart Institute in a study of effects of feeding certain fats and oils to boars on serum lipoproteins and atherosclerotic lesions. While blood cholesterol levels showed changes, the lesions, and their relationship to human conditions in heart disease were not clear. There was another cooperative study with the Institute of Home Economics on fats and cholesterol using male chickens.

2. Urinary calculi (kidney stones) in cattle and sheep. In studies of various nutritional factors, information from human medicine has been utilized and in turn has supplied factual material from results on cattle and sheep. While the problem is by no means solved, some advances toward control of kidney stones seem indicated.

3. Vitamin B_{12} investigations in connection with poultry, dairy cattle, and swine research. Some of the early research in animal husbandry materially helped in paving the way for the identification and elucidation of the role of vitamin B_{12} in human as well as animal nutrition. Further work reported the vitamin B_{12} content of milk and dairy products, especially cheeses.

4. Other vitamin studies on animals, including thiamine, riboflavin, pantothenic acid, pyridoxine, and vitamin A have contributed valuable information to human nutrition. For a number of years animal husbandry workers collaborated with personnel of Johns Hopkins Medical School in pernicious anemia and related blood disorders using swine as the experimental animal.

5. Nutritional properties of goats' milk. This study was carried out a number of years ago with the objective of studying the properties of goats' milk in comparison with cows' milk as a human food. One aspect involved cooperative studies with Johns Hopkins Medical School on infant feeding.

6. Dental caries, a study cooperative with the Johns Hopkins University a number of years ago, utilized pigs as the experimental animal. This was a pioneer study on mineral interrelations in an effort to gain an understanding of dental caries in humans. It paved the way for many subsequent laboratory animal studies.

7. Use of stilbestrol (sex hormone) in feeding beef cattle and residue problem in meat. This study, carried out in collaboration with the Food and Drug Administration, revealed no significant residues of stilbestrol in meat of animals fattened with relatively high levels of the material.

8. Vitamin A in butter. During World War II, in response to a request for information by the National Research Council as to the vitamin A value of milk and butter, the Department, in cooperation with 20 State agricultural experiment stations undertook to determine the normal variation as affected by reason, region, feeding practices, etc., in the vitamin A value of milk and butter in the markets of cities and towns in different regions. The results of this comprehensive study for the first time yielded reliable information on how much vitamin A there was contained in these products and how much dependence could be placed on them as a source of this vitamin so essential to normal health. It also showed regional differences and differences due to feeding practices in the vitamin A

value of milk and butter. It showed how it was possible through effective conservation and utilization of feeds to maintain a high content of this vitamin in these products.

9. Relation of calcium, phosphorus, and magnesium ratios to cardiovascular calcification. Research using purified diets for calves revealed magnesium deficiency and cardiovascular calcification on all-milk regimes. Adding calcium and/or phosphorus increased hypomagnesemia and tissue calcification. Levels of intake and Ca:P:mg. ratios both were important in causing symptoms. When natural feeds with similar intakes of magnesium with or without additions of calcium and/or phosphorus replaced milk, hypomagnesemia or tissue calcification did not develop. Further work is directed toward an explanation. This work may have implications to human nutrition in relation to cardiovascular calcification.

10. Unidentified nutrients in feed and food. Research work is in progress on one or more still unidentified nutrients in feeds and foods such as milk and eggs. Additional information leading to their role in nutrition, their presence in foods, their identification and purification may have important human nutrition implication.

11. Comparative value of food fats. Extensive studies with rats have been conducted to study the comparative growth-promoting values of butter and butterfat and margarines and vegetable fats. Animals in several generations on feeding regimens grew as well on one kind of fat as on the other.

12. Pesticide and herbicide residues in meat and milk. Studies in cooperation with Entomology Research Division and Food and Drug Administration have revealed the threshold levels of intake of several of the pesticides and herbicides beyond where they are deposited in the fat or are secreted in the milk of animals.

13. Trace mineral interrelations in animal metabolism are being studied in poultry, swine, cattle, and sheep. The findings are not only important in the nutrition and well-being of animals but to humans as well. Recent interest in aging in humans (geriatricts) suggests that information just referred to may become useful in this field.

14. Livestock production research has many other areas affecting human welfare, especially that dealing with improving the quality and nutritive value of foods, produced by livestock. Thus, developments in producing meat-type hogs, cattle, and sheep whereby the fat portion is reduced and the lean meat increased are important. Likewise, there are studies underway in developing dairy cows that produce milk having a lower fat content and a higher solids-not-fat content. Also worthy of mention are the strides in production of broiler chickens.

A. *Summary of Past Specific Projects of USDA in Collaboration With Other Federal Research Agencies*

NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

1. *Penicillin—the first commercial antibiotic.*—Mass production of penicillin was made possible through research at the Northern Division which resulted in discovery of the first and best organism, Penicillium chrysogenum NRRL 1951, B25, for the submerged culture process. Other important accomplishments were development of a fermentation process using corn steep liquor, lactose sugar, and other special ingredients; and development of methods for recovery of penicillin from fermentation broths. Extensive collaboration was carried on with interested Federal research agencies and through them with private and industrial research laboratories and drug companies. For these outstanding contributions, the Lasker Group Award was made to the USDA's Northern Laboratory Penicillin Team in 1947.

A memorandum of understanding existed with the Committee on Medical Research of the Office of Scientific Research and Development throughout the period of research, 1942–46, regarding the overall objective of this research.

There was a formal cooperative agreement with the National Academy of Sciences regarding penicillin nomenclature and later informal cooperation with this agency in the preparation of a monograph on penicillin chemistry.

There was informal collaboration with the War Production Board regarding methods for the production of penicillin by various drug companies and with the Food and Drug Administration and League of Nations Health Organization regarding development of international standards for penicillin.

2. *ARS Culture Collection.*—The ARS culture collection of the Northern Division is maintained as a repository for, and source of, pure authentic cultures of bacteria, yeasts, actinomycetes, and fungi. Among the strains maintained are cultures which produce antibiotics, steroids, vitamins, and alkaloids. Other strains of micro-organisms are maintained for purpose of assay of biologicals such as penicillin and vitamin B_{12}.

Through informal cooperation, the culture collection has supplied living pure cultures to the following agencies:

Department of Health, Education, and Welfare:

Fungus Studies, WS and WP Program, Cincinnati, Ohio.

Public Health Service, Laboratory of Infectious Diseases, National Institute of Allergy and Infectious Diseases, Bethesda, Md.

National Institutes of Health, Institute of Arthritis and Metabolic Diseases, Bethesda, Md.

Bacteriology Research Laboratory, Veterans' Hospital, Minneapolis, Minn.

Atomic Energy Commission, Medical Division, Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tenn.

3. *"Plan B" program.*—This was a classified program in which the Northern Division cooperated on the bass production of specified micro-organisms and their preservation in the frozen and desiccated states. Security regulations do not permit discussion of the gross results. Certain phases which of themselves are of scientific interest and which do not nullify the secret classification have been published in the scientific literature. The sponsoring agency was highly pleased with the contributions of the Northern Division group.

The work was done at the request of, and sponsored by, Department of the Army, Chemical Corps Biological Laboratories, Camp Detrick, Frederick, Md.

4. *Dextran—a blood volume expander for the Armed Forces and civilian defense.*—Research accomplishments include the following: (1) discovery of a particular bacterial strain. *L. mesenteroides* NRRL B–512, which has produced the most statisfactory dextran of all those clinically tested, and is now used by domestic producers of clinical dextran and by at least one foreign company; (2) development of processes for producing native high-molecular weight dextrans in high yield; (3) development of economical methods for the production of clinical dextran along with physical and chemical methods necessary for the specification and control of a reproducible product, and immediate dissemination of the information to industry, permitting the early domestic production of the clinical product by four industrial manufacturers of clinical dextran for use by the Armed Forces and Civilian Defense Agency; and (4) development of information leading to the establishment of a new industry using principles of industrial use of enzymes that may prove valuable in future application to farm crops.

The division's original proposal for the research program on a blood plasma extender was endorsed by the National Research Council, Division of Medical Sciences, Subcommittee on Shock.

There was informal cooperation with the Army Medical School, Walter Reed Hospital; Committee on Medical Research and Development; and Brook Army Hospital, Brook Army Medical Center, Fort Sam Houston, Tex. Other informal cooperation was with the Division of Organic and Fibrous Polymers of the National Bureau of Standards regarding physical characterization of dextran fractions as a basis for formultion of specifications for clinical dextran solutions.

Formal cooperation was subsequently established with the Office of the Surgeon General, Research and Development Division, Department of the Army, Washington, D.C., for a 2-year extension of the project, particularly for fundamental laboratory and engineering studies on clinical-type dextran. This extension of the project was undertaken to complete development of the Northern Division's process for the controlled enzymatic synthesis of clinical-type dextran using bacterial strain, *Leuconostoc mesenteroides* NRRL B–512F, and to develop further a process for the production of dextran based on the bacterial strain, Streptococcus sp. var. DS–50 NRRL B–1351, in order that processes would be made available for the most economical production of dextran.

During this extension period the Northern Division provided extensive consultation and advice through informal cooperation with the National Academy of Sciences–National Research Council, Washington, D.C., which served as coordinator of armed services projects and research contracts for clinical testing and physical science analyses and characterization of dextran preparations.

5. *Identification of micro-organisms.*—One of the functions of the ARS culture collection at the Northern Division is the identification and comparison of yeasts,

molds, and bacteria with authentic type cultures. A considerable number of cultures are received from medical sources which have been isolated from infections associated with chemotherapy, allergies, human and animal fungus diseases, water pollution surveys, and spoiled food.

Through informal cooperation, the Culture Collection Group has identified micro-organisms for agencies in the U.S. Government such as:

Department of Health, Education, and Welfare:

Fungus Studies, WS and WP Program, Cincinnati, Ohio.
Communicable Disease Center, Kansas City, Kans.
Communicable Disease Center, Public Health Service, Chamblee, Ga.
Division of Microbiology, Food and Drug Administration, Washington, D.C.
National Institutes of Health, Public Health Service, Bethesda, Md.

6. *Polymyxin—a unique antibiotic.*—Despite the phenomenal success of penicillin, and the significant, although limited, applications of streptomycin, there remained many infectious micro-organisms which resisted pencillin or streptomycin therapy. In the continuing search at the Northern Division for new antibiotics, several were discovered between 1946 and 1952. One of these was a water-soluble polypeptide which later became known as Polymyxin D. The growth of certain members of a large group of pathogenic micro-organisms unaffected by penicillin was held in check by polymyxin. Research by teams of scientists in the United States and England revealed that there was a family of polymyxins, most of which were too toxic for general systemic use. One of these compounds has been formulated into ointments and troches, and as tablets, alone or in combination with other antibiotics. The former preparations have been used successfully for topical and the latter for enteral treatment of various infections.

Through an informal agreement with the National Institutes of Health, samples of Polymyxin D were tested by the latter in animals infected with bacteria which cause brucellosis (undulant fever) in man.

7. *Enterotoxin.*—Enterotoxin is produced by *Staphylococcus aureus.* When it enters the human intestinal tract, as it does with food in which *S. aureus* has grown, food poisoning results. Workers at the northern division developed methods for large-scale production of enterotoxin so that sufficient quantities of pure toxin could be isolated for chemical and physical characterization and so that its physiological behavior could be investigated in cooperation with the Department of Defense.

Large quantities of the toxin were supplied to the Food Research Institute in Chicago where isolation, purification, and characterization were carried out. Material in quantity was also produced for the research staff of the Food and Drug Administration in Washington, D.C.

8. *Differentiation of micro-organisms by infrared spectra.*—An important part of the diagnosis of infections of man and animals is identification of the causative agents and a continual search is being made for more rapid means. An investigation was made at the northern division of the applicability of infrared spectrophotometry to the rapid identification of micro-organisms, especially bacteria. Study of several thousand spectral curves of micro-organisms in 32 genera, 145 species, and 356 strains was completed. Although it was not found possible to employ infrared spectra as a seperate system of identification, useful characteristics of some groups of organisms were determined.

Formal cooperation was with the Robert A. Taft Sanitary Engineering Center, U.S. Public Health Service, Cincinnati, Ohio.

9. *Recovery of morphine.*—The northern division developed a commercial process for the recovery of morphine from domestically grown poppy straw; analyzed and evaluated the process and the resulting product and designed a commercial-size poppy-processing plant; and estimated the capital investment for and operating costs of such a plant for use in future emergency situations when it might be impossible for this country to import opium.

This research was undertaken under division funds at the specific urgent request of representatives of the Materials Resources of the Munitions Board of the Department of Defense, Washington, D.C.

10. *Starch sponge.*—Starch sponge is a physical form of starch obtained by freezing and thawing a starch paste or gel. A process for its production was developed at the northern division. It was found that the sponge is solubilized into an assimilable form by action of enzymes in the animal body. Consequently, in some surgical applications, there is no need to remove the sponge. Water-insoluble materials that are added to the paste before freezing become an integral

part of the sponge. This suggests that starch sponge might be useful in surgery to carry medicaments, such as antibiotics, for slow release in the body as the sponge is solubilized by body enzymes.

For both animal and clinical experimental studies, the northern division has supplied several hundred pounds of the sponge in block and powder form to the Departments of the Army and Navy, Veterans' Administration, civilian hospitals, and members of the medical profession.

EASTERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

11. *Plant steroids for use as cortisone precursors.*—Since 1950, the Eastern Utilization Research and Development Division has been engaged in a study of plant steroids for use as cortisone precursors. Some of the steroid research was carried out in direct cooperation with the National Institute of Arthritis and Metabolic Disease of the National Institutes of Health. In addition, the results of Eastern Utilization Research and Development Division steroid research have been directly useful to other Federal agencies and industry in making improved cortisone analogs.

In the course of these researches, extracts were prepared from about 4,000 plant species. Many samples were sent to the National Heart Institute (NIH) for testing for hypotensive activity. Hundreds were tested by the National Cancer Institute and at least 10 species have shown ability to check sarcoma in rats. In addition, thousands of samples have been sent to the University of Texas and the Sloan-Kettering Institute for anticarcinogenic testing; to Merck Sharp & Dohme, Stanford University, and Michigan State University for antibiotic and antiviral testing; to Smith Kline & French for alkaloids with hypotensive activity; and to Ciba, Ortho Research Laboratories, Pfizer, and Mead-Johnson for general biological screening.

12. *Allergens in agricultural products.*—An authorized, joint investigation on allergens in egg vaccines was conducted with the Division of Viral and Rickettsial Diseases of the Army Medical School from 1942 to 1945. Other investigations, begun in 1935, have revealed the distribution and biochemical nature of allergens in agricultural products and determined the specific, injurious capacities of allergens to impair the utilization of those products. Studies on allergens of oilseeds led to isolation and biochemical characterization of cottonseed and castorseed allergens. These allergens have acquired wide biomedical significance with respect, particularly, to diagnosis and medical management of allergy attributed to the use of certain consumer products of these oilseeds. Specimens of these allergens have been the reference standards for both collaborative and independent laboratory and clinical investigations. Results of those studies are incorporated in current medical concepts pertaining to allergies caused by oilseeds and oilseed products. Isolation and biochemical characterization of allergens of agricultural products have been accomplished by the development of new or unique facilities, laboratory techniques, and analytical methods. These developments have been extended and adapted to biomedical research through both informal and authorized collaboration. Informally, technological contributions have been extended to biomedical investigations of the National Institute of Allergy and Infectious Diseases, the Food and Drug Administration, the Public Health Service Industrial Health Program, the Army Medical Nutrition Laboratory, and the Walter Reed Army Institute of Research.

13. *Removal of radioactive strontium from milk.*—A joint effort to develop dairy plant methods for removing strontium 90 from milk has been initiated by the Eastern Utilization Research and Development Division of the Department's Agricultural Research Service, the U.S. Atomic Energy Commission, and the U.S. Public Health Service.

The project is designed to provide answers to problems that may well arise in the future; the levels of radioactive fallout from past nuclear testing do not justify action to decontaminate milk supplies.

Small-scale laboratory studies by U.S. university scientists and by Canadian and British investigators have indicated that it may be possible to remove strontium 90 from milk by a chemical process employing ion exchange resins. Under this new project further investigation of ion exchange resins and other decontamination methods will be conducted. Laboratory-scale results will be carried out on a pilot plant basis so as to insure availability of a practicable and economic process.

SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

14. *Intravenous fat emulsion.*—A new fat emulsion for intravenous feeding developed from cottonseed oil by scientists of the Southern Division, as members of the U.S. Army Surgeon General's Task Force on Intravenous Fat Emulsions, should provide better nourishment for patients who cannot be fed by mouth than the commonly used glucose solution. Long-term intravenous administration of the new emulsion at high levels to animals has given very encouraging results. The emulsion is now ready for clinical tests on human subjects. As both the caloric value and tolerance level of the emulsion are high, it should successfully supply the patients caloric requirements. The glucose solutions and protein hydrolysates conventionally used for intravenous feeding cannot be given in sufficient quantities to supply all the calories needed by the patient. The new fat emulsion offers promise of extending the usefulness of intravenous feeding.

15. *Semi-elastic cotton bandage.*—The yarns in cotton gauze can be kinked and crimped to produce surgical bandages which have self-clinging and elastic properties. These properties permit bandaging of any portion of the body because the bandage conforms smoothly with body contours and exerts less restriction on the movement of the bandaged area. The all-cotton semi-elastic conforming bandage, termed "the only important improvement in surgical dressings in 20 years," was developed at the Southern Utilization Research and Development Division and evaluated by the Office of the Surgeon General. The evaluation of the new-type bandage led to its being specified as a procurement item for the armed services and for civil defense stockpiling. The bandage is currently in commercial production and available as a consumer product in drugstores.

Elastic properties are imparted to ordinary open-weave cotton gauze by a chemical treatment. This gives crimp and kinkiness to fibers and yarns of the loosely woven cloth, so that the bandages easily stretch in both directions, and are essentially self-fitting and self-tightening when applied with moderate tension. The surface of the material is such that layers of the bandage tend to cling together, in contrast to the slipperiness of ordinary gauze, so that better bandaging is possible. These characteristics make the material especially suitable in orthopedic surgery. It is also excellent for head dressings, and because of its self-tightening effect, this semi-elastic gauze is especially useful where light pressure on a dressing is desired, as in burns and skin grafts.

B. Some of the More General Ways in Which the "Fruits" of the Department's Studies May Have Been of Use to Such Agencies Whether or Not There Was Specific Planned Collaboration

1. *Screening chemical compounds for anticarcinogenic activity.*—The National Institutes of Health, Public Health Service, Department of Health, Education, and Welfare, are engaged in a program for screening chemicals in an effort to find sources of new and effective anticancer agents. Through informal cooperation the North Division has submitted plant extracts, chemical compounds, and substances unavailable from other sources. Examples of materials submitted included methyl 2,6-diaminoisonicotinate, dextran, unbleached lecithin, phosphomannan, amino acid derivatives, and S-dichlorovinyl cysteine. The last compound has been reported by other cooperators to be effective in some cases of polycythemia.

2. *Aplastic-anemia-causing factor applied to medical research.*—A problem of determining the cause of toxicity in soybean oilmeal feed, processed with a certain chlorinated solvent, resulted in identification and synthesis of the causative factor. Its biological properties immediately aroused the interest of medical researchers. For the first time, an agent was available for producing controlled aplastic anemia in animals, the cause of which is unknown, and facilitated the search for a cure of this human ailment so bothersome in cancer therapy, and from which two or three thousand people in the United States die each year. Certain properties of the new agent stimulated tests now underway for therapy of various forms of cancer. Experiments carried out at the Minnesota Agricultural Experiment Station under contract with the Atomic Energy Commission showed that controlled radiation sickness could be induced in animals by injections of the new agent. The chemistry worked out in synthesizing the new aplastic-anemia-causing agent opened the way for many new compounds of interest to medical chemistry.

Informal cooperation has been maintained with the Cancer Chemotherapy National Service Center, National Institutes of Health, for dissemination of samples and information of the new agent to their researchers.

Informal cooperation has also been maintained with the Food and Drug Administration relative to foods that might be processed under conditions similar to those that give the toxic agent in soybean oilmeal feed.

3. *Rutin, use in treatment of blood vessel abnormalities.*—In collaborative medical studies workers in the Department's Eastern Utilization Research and Development Division discovered that rutin and related flavonoids are useful in the treatment of various disease conditions associated with hemorrhage and weak blood vessels. This work has led to worldwide biomedical investigations on flavonoids. These compounds have now been found in a wide variety of plants; Department scientists first prepared rutin from flue-cured tobacco, later from buckwheat; today, buckwheat, eucalyptus, and *Sophora japonica* (Chinese scholar tree) are the chief source materials for commercial rutin production; citrus also supplies flavonoid compounds with reported biological properties. Department workers developed manufacturing processes and aided industry in the commercial production of rutin. Further, through this research, quercetin, a flavonoid made from rutin, was found to be more effective than rutin in the treatment of blood vessel abnormalities. Continued pharmacological studies on the metabolic fate and the mode of action of flavonoids in the animal body are still in progress at the Department's Western Utilization Research and Development Division. This research finally led to the publication of the first book in this field entitled, "Rutin and Related Flavonoids." This is now a standard text and reference for biological scientists in the flavonoid field and for clinicians in the practice of medicine.

4. *Purified milk proteins for study of their antigenic and allergy merchanism.*—The program of the Department's Eastern Utilization Research and Development Division on the separation of pure milk proteins has been of considerable importance in furnishing medical investigators with highly purified milk proteins for their antigenic and allergy mechanism studies. For instance, the late Dr. Bret Ratner, a leading pediatric allergist, requested that we furnish him relatively large amounts of purified milk proteins for allergy studies. He obtained a grant from the U.S. Public Health Service specifically to make studies on the milk proteins which we furnished him. The high degree of purity of these proteins was of primary importance in these investigations, since complicated cross reactions were eliminated, making possible for the first time definite conclusions concerning the relative antigenic properties of each milk protein tested. It was also found that the small amount of the unchanged protein passing through the intestinal wall into the bloodstream of individuals varied considerably and is probably a factor in food allergy.

5. *Chemical compounds from agricultural products for screening by Chemical-Biological Coordination Center.*—Beginning with the period immediately following World War II until its activities were terminated in 1956, close cooperation with the Chemical-Biological Coordination Center was carried out on screening compounds synthesized at the Department's Eastern Utilization Research and Development Division, for biological activity. Listings of compounds synthesized by the Division in its research were submitted to the center, which in turn forwarded them to their various collaborative testing agencies to determine their interest in testing any of the compounds. Samples were supplied to the center based on requests from the screening agencies. Reports of test results on samples supplied were ultimately furnished us. A large variety of biological tests were performed by the screening agencies including tests for anticancer, antituberculosis, bactericidal, and many other activities. Of the hundreds of compounds tested, a large number were found to be biologically active against a particular disease or organism. Frequently additional quantities of the particular compounds were supplied on request from the screening agencies for further testing. In this way a substantial contribution was made by the Department in the national coordinated effort to obtain information about the biological activity of a large number of chemicals that might be useful in medicine and public health.

6. *Development of instruments for measurement of physical properties of biological materials important to medicine.*—Progress in biomedical research is greatly dependent on availability of better physical tools and methods. A light-scattering photometer and differential refractometer were developed at the Eastern Utilization Research and Development Division for measuring molec-

ular weights and sizes of large molecules. These instruments are commercially available and are in use in hundreds of research laboratories throughout the world. They have found important use in biomedical research for studying the properties of proteins, ribonucleic acids, viruses, polysaccharides, plastics, and components of foods and pharmaceuticals. The light-scattering method turned out to be the only reliable method of evaluating clinical dextrans for use as blood-volume expanders. In order to be effective for this purpose the dextrans must be in a narrow range of sizes similar to that of serium proteins. Military specifications cite the above-mentioned photometer for evaluating clinical dextrans.

7. *Development of physical and chemical methods for use in the analysis of lipids from body tissues to expedite studies of the role of dietary fats in atherosclerosis.*—Publicity on the possible role of dietary fats in atherosclerosis and related coronary diseases stimulated an unprecedented surge of interest and research in all phases of lipid metabolism by medical and nutrition investigators. Special micro and semimicro methods of extraction, fractionation, and analyses of lipids from body tissues were needed to expedite research in this field. Based on a wide background of experience in the chemical composition of animal fats, workers in the department's Eastern Utilization Research and Development Division were called upon by numerous medical and nutrition groups to lend their assistance in the development of this specialized methodology. In collaboration with personnel from Temple and Harvard Medical Schools, department chemists developed reproducible and quantitative methods for the purpose and applied the methods for obtaining pertinent data on the character and composition of lipids from such tissues as blood plasma and cells, atheromas, liver, and skin. These methods were published and are being used widely by many medical and nutrition groups who are investigating the relation of dietary fats in coronary and metabolic disorders.

8. *Basic information on the composition of tobacco and tobacco smoke.*—Tobacco and tobacco smoke contain hundreds of chemical compounds, many of which have not been identified. More knowledge is needed on the chemical composition of tobacco and its combustion products and on the relationship between chemical composition and quality. Basic research to accumulate such knowledge has been in progress for a number of years in the Eastern Utilization Research and Development Division. Emphasis has been on isolation and identification of compounds suspected to influence the quality of tobacco or tobacco smoke, and on methods of analysis for important chemical constituents. An increasing amount of biomedical research is in progress in other Federal agencies and in medical research laboratories to investigate relationships between smoking and health. The basic information we have obtained on chemical composition and on methods of separation and analysis have been, and will continue to be, of immediate use to biomedical research programs.

9. *Bio-oxidation process for dairy wastes.*—A bio-oxidation process was developed in the department's Eastern Utilization Research and Development Division to reduce the pollution of rivers and lakes by the potent waste of the dairy industry. The Public Health Service has been interested in the application of this system for the purification of other industrial wastes, and has carried out research based on the principles of the department's bio-oxidation procedure.

Since waterways contaminated by industrial wastes are a poor source of drinking water, and a possible focus of disease, the Public Health Service is trying to find efficient and economical waste treatment methods to eliminate the pollution problem. At the Robert S. Taft Environmental Health Center at Cincinnati, Ohio, wastes from the potato chip industry, and the wood sulfite waste liquor from the paper pulp industry have been treated successfully by the department's bio-oxidation method. Engineers and scientists at the Taft Center also recommended this procedure for the treatment of other wastes. The National Institutes of Health have supported research on the bio-oxidation of citrus waste in Florida.

The Public Health Service also requires rapid techniques to be used in the field and they are interested in the chemical oxygen demand test developed in the department's research for the rapid determination of the pollution load of a waste of a river.

10. *Tomatine—an antifungal agent.*—Tomatine, a crystalline steroidal alkaloid, possessing antifungal activity was first isolated in work at the department's Eastern Utilization Research and Development Division from the leaves and stems of a wild tomato species. The first commercial supply of tomatine was produced in Buenos Aires, Argentina, using the process developed in this re-

search. Clinical experience there indicates that an ointment of tomatine is useful in the treatment of mycotic skin diseases such as athlete's foot. Recent clinical studies in this country seem to give confirmation to foreign reports. The summer of 1958 marked the first attempt at commercial production of tomatine in the United States. At present one of the most promising uses for tomatine appears to be as a coupling agent in a new, easier quantitative method for the determination of blood cholesterol.

11. *Preparation of oxidized and polymerized fats for nutritional and physiological studies.*—The role of fats in degenerative diseases, such as atherosclerosis and coronary thrombosis, has been the subject of intense interest and speculation recently. Large quantities of fats are used in the commercial deep fat frying of various foods, notably potatoes, doughnuts, and seafood, and are consumed along with these foods. In the frying process, fats are exposed to air and high temperatures for relatively long periods during which they may undergo deterioration due to oxidation and thermal polymerization. The nutritional and other physiological properties of these oxidized and polymerized fats, and their breakdown products, are not known.

In a collaborative investigation between scientists from the Eastern Utilization Research and Development Division and Columbia University's College of Physicians and Surgeons, laboratory samples of oxidized and polymerized fats, as well as numerous fractions obtained from them, were fed to rats on synthetic diets. Oxidized and polymerized fats retarded the growth of rats and were mildly to severely toxic depending on the extent of oxidation and polymerization, the nature of the original fat and the quantity in the diet. Fresh fat had a sparing effect on nutritionally undesirable material.

Work of this type is of value to agencies concerned with human nutrition and health. This work may provide fundamental information on methods for controlling weight and serum (blood) cholesterol, and be useful in determining the best techniques to be employed in the deep fat frying of foods to minimize undesirable components.

12. *Investigations of the flavonoids.*—The flavonoids are a group of closely related compounds distributed widely in the plant kingdom. Among them are rutin in asparagus and the buckwheat plant, hesperidin in oranges, and naringin, which is responsible for the bitter taste of grapefruit. Rutin and hesperidin have been and continue to be the subject of much investigation for their value in treatment of patients exhibiting abnormalities of the blood capillaries. Results to date indicate that beneficial effects of the flavonoids stem from (1) antioxidant properties which enhance the effects of vitamin C and of the hormone adrenalin secreted by the adrenal glands, and (2) cortisone-like action due to stimulation of the pituitary and adrenal glands. Feeding the flavonoid quercetin (obtained from rutin) to experimental animals has been shown to induce fluorescence of new bone when viewed under ultraviolet light, an observation which may be important in studies on bone growth and diagnosis of bone tumors. Flavonoids have been shown to be converted by the animal body into a variety of organic acids which are excreted in the urine where they exert a mild antiseptic action. Conversion of the flavonoids to the organic acids revealed the ability of the animal body to carry out hitherto unknown chemical changes. Knowledge of such changes enabled other investigators to devise a simple chemical test on urine for diagnosing existence of a tumor on the adrenal gland as a cause of high blood pressure. USDA-sponsored work at Stanford University School of Medicine showed that rutin and quercetin have antiviral properties and quercetin has some prophylactic (preventive) value against mouse pox and rabies.

13. *Salmonella in foods.*—Salmonella micro-organisms occur in various foods and are occasionally the cause of gastrointestinal enteritis following the consumption of unheated or mildly heated food items. Improved methods of detecting and counting Salmonellae have been developed and their growth and survival habits have been thoroughly investigated. It was found that Salmonella strains isolated from egg products can be destroyed by moderate doses of ionizing radiation or by ultraviolet light. Development of these micro-organisms can be suppressed by the use of Salmonella antagonists in the fermentation of egg white prior to drying. These results provide a basis for development of improved procedures for elimination of Salmonellae from various food products.

14. *Relation of diet to toxicity.*—Study of the chronic toxicities of chemical compounds has demonstrated repeatedly that evidence for the toxicity or degree of toxicity of a compound may depend upon the composition of the basal diet fed to the experimental laboratory animals. It has been strikingly shown that two

basal diets, both of which consist of natural foodstuffs and permit normal growth, reproduction and longevity, may not yield the same toxicity data for a given compound. If adequate diets modify susceptibility to toxicity in humans as shown to be the case in rats, then a problem of far-reaching consequences exists.

15. *Toxicity of fluorides.*—In the early thirties measurements were made on the chronic toxicities of four common fluorides then in use as pesticides in apple orchards. All four were found to cause bleaching of the teeth of rats. This effect is the counterpart of the mildest form of fluorine toxicity occurring in persons living in areas where the natural fluorine content of the water supply causes abnormalities of the teeth. It was observed that the daily intake of fluoride required to bleach rats' teeth was less when the basal metabolic rate of the animals was increased by administration either of thyroid extract or pituitary hormone. Apparently no studies have been made on the possible relation between metabolic rate of humans and the level of fluoride intake required to produce specific fluoride effects. Importance of such a study is potentially great in view of the increasing adoption of fluoridation of public water supplies.

16. *Peanut products aid hemophiliacs.*—Presence of some substance in peanuts beneficial to hemophilia victims, noted at the Louisiana State University, is suggested by the experience of three persons with the disease who have been conducting personal experiments with peanut meal in various forms. The results of limited work with hamsters are compatible with the observations of the three hemophiliacs. Oral ingestion of peanut flour or an alcohol extract of defatted peanut meal equivalent to from 1 to 2 pounds of peanuts per day was observed to give hemophiliacs relief from pain and swelling indicative of active hemotoma in hemophilia. The Southern Division has supplied the peanut flour, and the concentrate containing the active factor in peanuts responsible for the relief in hemophilia observed in the initial experiments. It is hoped that medical research will determine if the phenomena observed in the limited experiments is general for AHF hemophiliacs.

RESEARCH ACTIVITIES OF THE INSTITUTE OF HOME ECONOMICS RELATED TO BIOMEDICAL RESEARCH PROBLEMS OF OTHER FEDERAL AGENCIES

1. Methods for evaluating the nutritional effects of school lunches—Cumberland Study. Both Agriculture and Public Health stationed staff at the site of study to collect data on physical and nutritional status and food habits. Analyses of food and blood samples, evaluation of diet, and statistical analyses of data and preparation of publication were carried out later in Human Nutrition Laboratories.

2. Western Regional Cooperative Study of Nutritional Status. The health agencies provided a medical officer and moble unit for physical examination of persons, as the study shifted from one State to another. Data were collected on nutritional status, food habits, and other factors considered important. Human Nutrition furnished the salary of the medical officer and of various junior staff members associated with the team.

3. Relation of vitamin E deficiency in mothers to retinolental fibroplasia in young.

Staff in Experimental Nutrition (Beltsville) observed damage to retina of eyes of young rats of mothers on restricted diets; consulted with Dr. Parks (NIH) on possible significance and grew animals for comparative studies by him. Findings led to him hypothesis which eventually explained the cause of blindness developing in premature human infants after birth.

4. Fatty acid tables for use by FAO and WHO in international studies of diet appraisal in relation to epidemiology of atherosclerosis.

A staff member in Human Nutrition Research was given leave to go to Rome for 6 months, salary reimbursed by NIH. Tables were set up giving fatty acid data for the list of foods of other countries appearing in FAO food composition tables previously in use for other nutrients commonly calculated in diet appraisal.

5. (Proposed) plans are being developed for the Human Nutrition Research Division of the ARS to collaborate in studies of epidemiology in this country by analyses of foods sampled from the locale of the studies, to provide more specific data on fatty acids and other nutrients for evaluating diets of individuals

BIOMEDICAL RESEARCH IN MARKET QUALITY RESEARCH DIVISION

Some research in the Market Quality Research Division is related to the biomedical field. We have no projects in which we are collaborating with other Federal agencies formally, but there is some informal collaboration. I have listed a number of projects which have been fruitful or may be so to the general field of biomedicine.

1. Disease agents in dressed poultry, a project initiated to determine the health hazards in the handling and processing of poultry and methods of inspection to avoid such hazards and to assure wholesome, good quality poultry meat. This work is being done at the University of California by the Departments of Veterinary Medicine and Poultry Husbandry.

2. Research on the aging of plant and animal tissues, the changes in structure and biochemical makeup with age and senescence to provide us with means of preventing undesirable changes and promoting desirable ones. Studies on phenolic compounds and development of off colors in fruits are related to certain problems in blood chemistry and the storage of blood. Informal collaboration with medical workers at the University of Washington and NIH at Bethesda has come from this field of work.

3. Respiration studies on fruits and vegetables using mitochondria and Warburg techniques are of interest to workers in the biomedical field for the pathways of enzymatic reactions are much the same in animal and plant tissues.

4. Several techniques worked out for the study of problems in agriculture became useful to medicine. A recent example is the spectographic method developed to study biochemical changes in germinating seeds, particularly cytochrome oxidase activity. This method does not injure the seed, for it involves only the passing of light through it. These reactions are of interest in the brains of animals fed toxic materials, and live mice will be studied with our instrument by medical researchers from NIH before they build similar instruments.

5. Study of seeds to explore the initiation of life processes in dormant living tissue. The means by which cells become active that were once inactive is of interest in cancer research.

6. Toxicity studies of chemical residues in foods, carried on prior to recommendation for use as protective treatments to prevent insect damage to stored products or damage by molds, yeasts, and bacteria are of medical interest. Similar work is done in materials used as sprout inhibitors for potatoes or onions, or storage disorders such as apple scald.

7. Research done in the field of microbiology for the protection of foods from spoilage and deterioration may furnish the medical man information helpful in the study of human pathogens.

8. Of indirect interest to biomedical research is the research done in this division on vitamin C and provitamin A in fruits and vegetables, the amount present, its loss or gain, and the effect of storage environment on their retention.

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Exhibit 19

Chart on Department of Agriculture Research in Connection With Cardiovascular Problems

DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH SERVICE

UTILIZATION RESEARCH AND DEVELOPMENT DIVISIONS

Projects contributing to improved methodology in the lipid field providing more specific methods and tools for accurate determination of fatty constituents of foods and mammalian tissues tc elucidate the role played by fats in cardiovascular diseases.
Research on the mechanism of hydrogenation of unsaturated fats and positive identification of the components produced so that correlations can be made by medical scientists and nutritionists between these structures in food products and demonstrable effects upon the cardiovascular system.
Testing fatty and other materials on experimental animals to determine effects upon the cardiovascular system.

RESEARCH IN CONNECTION WITH CARDIOVASCULAR PROBLEMS

INSTITUTE OF HOME ECONOMICS DIVISIONS

Quantitative distribution of nutrients--nitrogen, amino acids, fatty acids, minerals, vitamins--and related constituents in foods.
Biological value of foods, including factors affecting the physiological utilization of nutrients.
Human utilization of food and factors affecting metabolism of nutrients.
Human requirements for specific nutrients, such as fatty acids, amino acids, and minerals.
Quantities of food, commodities, and nutrients used by people in different circumstances.
Tables of composition and nutritive values of food.
Research-based source materials for nutrition and consumer education.

STATE EXPERIMENT STATIONS DIVISIONS *

Research concerned with the physiological changes associated with spontaneous atherosclerosis and their role in the mortality and declining efficiency of animals as they age.
Research to determine the specific causes of fatal aortic rupture in turkeys and the pathological changes associated with the disease.
Studies of the effect of foods or diets of varying composition on general physiology, with particular attention to effect on cholesterol and lipid levels in blood and other tissues; limited research on the sodium content of foods; limited research on physiological responses of normal and mild cardiac subjects at work in the home.

* Federal grants to State Agricultural Experiment Stations - extramural research.

FARM RESEARCH DIVISIONS

Research on bacterial, viral, mycotic, rickettsial, and parasitic diseases having a direct or indirect effect on the cardiovascular system of verterbrates.
Toxicological studies to determine chemical effects on the cardiovascular system.
Levels of magnesium in relation to deposits of mineral salts in circulatory tissues of calves.

EXHIBIT 20

LETTER OF JULY 1, 1960, FROM DEPARTMENT OF AGRICULTURE ON SCREENING PROCESS FOR ITS RESEARCH GRANTS

U.S. DEPARTMENT OF AGRICULTURE,
AGRICULTURAL RESEARCH SERVICE,
Washington, D.C., July 1, 1960.

DEAR MR. CAHN: This is in response to the request made by * * * your office to Dr. Van Houweling in ARS for a description of the screening process for review of intramural and extramural research projects in the Department of Agriculture. It was indicated that you were particularly interested in the percentage of proposals which were not approved. This presumably relates mainly to the Department's extramural program.

First, with reference to in-house research, all work is classified at three project levels: (1) Financial projects, (2) work projects, and (3) line projects. Your interest would, I am sure, be limited to only work and line projects, mainly the latter. Work projects describe major areas of work within the research divisions and tend to vary little from year to year and to a considerable extent provide the basis for budget justification. On the other hand, the line projects represent much narrower segments of research which are subject to completion within a reasonable length of time, and, in any event, must be reviewed and revised at intervals of not more than 5 years. As new line projects originate at the branch level and are reviewed at both the division and service level, they are referred through our Central Project Office for review by all other divisions which may have an interest in the area concerned. Through this process many project proposals undergo further revision and some few may never be approved because of duplication or other factors concerned. A high percentage of these line projects, after the review and coordinated process, are finally approved.

With reference to our extramural program, both our statutory grants to State agricultural experiment stations and a modest contract research program are involved. The statutory grants are so different in nature from the grant programs administered by the National Science Foundation, NIH, and AEC, that the percentage of project proposals which are rejected under our grants bears little relationship to the rejections of these other agencies. This is primarily due to the fact that we are dealing with institutional grants which are for the most part distributed by formula, so that as soon as an appropriation bill is enacted into law each experiment station knows quite precisely the sum to which it will be entitled. They therefore develop their program of research projects with full knowledge of the amount of money they will receive. Our review process, therefore, does not involve a comparison of the relative merits of projects submitted by different institutions. Rather, we are concerned only with the merit of the individual State project proposal per se. Hence, our review is mainly for the purpose of coordination and prevention of unnecessary duplication. It is on this basis, as I believe I have stated to you in our conversations, that our actual rate of rejection was not more than 1 or 2 percent. On the other hand, most of the other Federal agencies administer their money on the project grant basis and may well receive three, four, or five times as many project proposals as available funds can support. They must, therefore, carefully weed out these proposals and approve those which are most worthy within the limit of funds available.

While the Department's contract research program could be subject to this same situation, the facts are that our contract authority is considerably narrower in scope and hence the Department has never been faced with a much greater volume of contract proposals than they have been able to finance. More often, actually, they seek out agencies which are particularly equipped to carry out particular research undertakings within the framework of our authorization. Therefore, we do not have a high percentage of refusal on contract proposals.

Please call us if you desire further information on this subject.

Sincerely yours,

E. C. ELTING,
Deputy Administrator for Experiment Stations.

EXHIBIT 21

LETTER OF AUGUST 1, 1960, FROM U.S. DEPARTMENT OF AGRICULTURE ON EXTENT OF ITS RESEARCH PROGRAMS REGARDED AS HAVING DIRECT IMPACT ON MEDICAL SCIENCE

U.S. DEPARTMENT OF AGRICULTURE,
AGRICULTURAL RESEARCH SERVICE,
FOREIGN RESEARCH AND TECHNICAL PROGRAMS DIVISION,
Washington, D.C., August 1, 1960.

DEAR SENATOR HUMPHREY: This is in reply to your request of June 7, 1960, for information concerning research performed in the Department of Agriculture with a presumed direct impact on medical science. The meeting with Mr. Julius N. Cahn, project director, was most helpful in arriving at a common denominator to be used as to the type of projects to be included in the study.

First, nine major subject-matter categories were selected as contributing directly to medical science. A much larger number of categories could have been included since a very large portion of the Department's research program is directed toward insuring a wholesome and nutritious food supply for our Nation, and thus would have varying degrees of medical implication. Actually, outside of the veterinary medicine category, none of the others have as their objectives medical research but the results have medical significance that goes beyond being merely health related. Not all projects falling in the nine major categories have been included since many were considered as having only incidental or indirect medical impact.

The intramural projects are those conducted by Department personnel. The extramural projects include those conducted with Federal-grant funds to State agricultural experiment stations, contracts with universities, foundations, etc., and foreign research grants under Public Law 480.

The attached table gives by the nine categories the number of intramural and extramural projects, the estimated annual allocations, and estimated man-years. It will be apprepciated that only portions of certain projects have medical impact; thus, the data are estimates but do furnish an approximation of the magnitude of the projects. A comparison as to the proportion of extramural and intramural research is carried at the bottom of the table.

The second part of your request had to do with current printed outlets which inventory research projects which are supported directly or indirectly by the Department. The Central Project Office of the Agricultural Research Service is a repository for descriptive documents of all current research projects of the Department. Department research divisions and the State agricultural experiment stations have been able for more than 10 years to quickly obtain information on current extramural and intramural research projects conducted by the Department. The availability of this service was made known to the Bio-Sciences Information Exchange several years ago.

Regular and irregular publications (copies enclosed) related to Department-supported research projects are as follows:

1. "The Research Program of USDA—Organization, Coordination, Nature, and Location." Miscellaneous Publication No. 779. Issued November 1958 (irregular).

2. "Current Research in USDA" (irregular). A series of 43 reports, arranged by subject, briefly describing all current department research projects (approximately 3,000 projects).

3. "Federal-Grant Research at the State Agricultural Experiment Stations" (irregular). This series contains 24 subject-matter areas which are subdivided into 53 subareas of research. The series gives a brief description of the current Federal-grant projects.

4. Line Project Approvals and Discontinuances Recorded During June 1960 (monthly). Distributed to all U.S. Department of Agriculture research units, all State agricultural experiment stations, and to others on request.

5. Projects Approved by the State Experiment Stations Division for Use of Federal-Grant Funds, May–June 1960 (bimonthly). Distributed to all State agricultural experiment stations and to all U.S. Department of Agriculture directors of research.

The third request dealt with a draft chart representing general ways in which units within the Department of Agriculture contribute directly or indirectly to knowledge which may be of use in connection with cardiovascular problems. Such a chart has been prepared and is enclosed, showing the basic studies underway that contribute to information on cardiovascular diseases problems.

Sincerely yours,

K. A. HAINES, *Assistant Director.*

Research programs of the Agricultural Research Service, the Agricultural Marketing Service, and the Forest Service having direct impact on medical science, fiscal year 1960

Category	Number of projects		Estimated allocations (in thousands)	Estimated man-years [1]
	Intramural	Extramural		
1. Veterinary medicine	129	276	$9,000	160
2. Mammalian nutrition	102	224	3,450	100
3. Food composition	9	41	600	16
4. Food consumption and dietary levels	8	5	305	9
5. Insects affecting man and animals	25	2	810	12
6. Toxicology and pharmacology	19	53	1,480	40
7. Drug plants	7	8	240	12
8. Allergens	2	1	120	4
9. Radioactive materials (removal from food)	1		25	1
Total	302	610	16,120	354

[1] Professional GS–12 or above or for extramural research, those paid annual salary of $8,000 or over.

NOTE.—Of the total estimated allocations, approximately $3,860,000 (24 percent) and 147 man-years (42 percent) are for extramural research at 68 locations or institutions. There are 103 locations for intramural research.

EXHIBIT 22

LETTER OF SEPTEMBER 15, 1960, FROM DEPARTMENT OF AGRICULTURE ON REGISTRATION OF RESEARCH PROJECTS AND RELATED MATTERS

U.S. DEPARTMENT OF AGRICULTURE,
AGRICULTURAL RESEARCH SERVICE,
Washington, D.C.

DEAR SENATOR HUMPHREY: This is in reply to your letter of August 15, 1960, requesting the views of the Department of Agriculture on the problem of interagency coordination of research.

We have prepared this information in two parts (see attached annex I and annex II). Annex I is somewhat of a general statement on the problem of interagency coordination. Annex II covers the specific information requested of this Department as compared to the general request to agencies contained in annex I.

Sincerely yours,

BYRON T. SHAW, *Administrator.*

ANNEX I

U.S. DEPARTMENT OF AGRICULTURE

Agricultural Research Service

Washington, D.C.

Subject: How this agency views the problem of interagency coordination.

The first factor to be considered in the coordination of biomedical or any other area of research is the perfection of a mechanism within the agency to coordinate its own intramural and extramural activities. The Department of Agriculture, for example, has to consider research both in the State agricultural experiment stations and in its own laboratories. Within this large and extensive area, research coordination methods and procedures have been developed over a long period of years and are considered to be highly effective at the present time.

Information on research being carried out in agriculture is contained in the project files of the central project office and the State agricultural experiment station division. These files are the basis for effective coordination of research in agriculture and are used by the Administrator of the Agricultural Research Service, who is the designated research coordinator of the Department for this purpose. Other governmental agencies, private institutions, and industrial concerns have been informed of these files and of the availability of the information contained in them.

It should be emphasized that research agencies now employ many informal means for interagency coordination. Included are scientist-to-scientist contacts,

interagency committees, meetings, symposia, seminars, professional societies, and the scientific literatures. These voluntary coordination efforts are necessary and desirable since there is overlapping of interests between the agencies. For example, the Department's research in the field of human nutrition has as its objective the maintaining of a well-fed population, while the interest of the Department of Health, Education, and Welfare is directed to the effects of nutrition on heart disease, cancer, arthritis, and other ailments. In the veterinary field, the Department's interests are in animal health, while the Department of Health, Education, and Welfare is primarily interested in the zoonotic aspects of animal diseases as they may affect human health. Other examples could be cited but these two illustrate areas where overlapping is to be expected or where close working relationships between agencies is mutually helpful.

Recently, interagency coordination problems have been receiving attention by the relatively new Federal Council for Science and Technology. The Council, chaired by a special assistant to the President and including in its membership high-level agency representatives, can continue to be of great assistance in coordinating Federal scientific activities.

Collaboration between the Department of Agriculture and other agencies is illustrated in the following two tables which indicate the number of projects that involve cooperative research. Of particular interest, other than the number of projects involved, is the number (30) of different Federal agencies with which the Department collaborates on research projects.

Collaboration of USDA with other Federal agencies

Service	*Number of research projects*
Agricultural Research Service	186
Agricultural Marketing Service	61
Farmer Cooperative Service	6
Forest Service	67
Total	320

Current USDA projects involving collaboration with other Federal agencies

Federal agency	*Number of research projects*
Atomic Energy Commission	10
Commerce Department	79
Defense Department	71
Federal Reserve System	7
General Services Administration	7
Department of Health, Education, and Welfare	43
Interior Department	107
Labor Department	18
Smithsonian Institution	13
State Department	8
Tennessee Valley Authority	10
Treasury Department	10
Virgin Islands Corporation	12
Other [1]	28
Total	[2] 423

[1] Covers cooperative work with 17 different organizations.
[2] Total projects involving collaboration with one or more other Federal agencies is 320. The figure of 423 results from the fact that some projects involve collaboration with two or more other Federal agencies.

This Department is not represented ex officio on another agency's study section, grant council, or the equivalent in the true sense in which the request is made. There are departmental representatives, however, on the following representative interdepartmental committees which have research coordination functions:

1. Federal Council for Science and Technology (and its subcommittees)
2. Interdepartmental Committee on Children and Youth
3. Interdepartmental Committee on Nutrition for Defense

4. Interdepartmental Committee Advising Health, Education, and Welfare on Health Surveys
5. Interdepartmental Committee on Radiation for Food Preservation
6. Interagency Advisory Committee on Community Air Pollution
7. Interagency Committee on Water Resources (and its subcommittees)
8. Interagency Advisory Committee to the Executive Agent for a Biomedical Effects Test Series
9. Armed Forces Pest Control Board
10. Committee on Agricultural Pests
11. Interdepartmental Committee on Pest Control
12. National Research Council, Division of Biology and Agriculture

Despite the efforts now being made, it is recognized that there is a growing problem with respect to coordination of the research efforts of the several Federal agencies. The Department believes that effective coordination of this research can be achieved if all research agencies register their projects with a central office, such as the BSIE, particularly if certain precautions are observed. Careful thought should be given to developing procedures that do not become so burdensome that their effectiveness to the supplier, coordinating office, and receiver of the information is lost or greatly reduced.

ANNEX II

U.S. DEPARTMENT OF AGRICULTURE

Agricultural Research Service
Washington, D.C.

See Annex I above

1. A statement of present official policy on the part of the Department of Agriculture as regards proposed registration of projects with and financial contribution to the Bio-Sciences Information Exchange.

The U.S. Department of Agriculture has strongly considered the overall benefits that could be derived by registering its extramural projects with, and making financial contributions to, the BSIE. Our decision would be based on two criteria: (a) that all Government agencies conducting bioscience research participate, and (b) that the BSIE register intramural projects as well as extramural.

The reason for the first criterion—of all agencies participating—is self-evident if this is to be an effective tool for coordination. The second criterion can best be explained by citing examples from U.S. Department of Agriculture project records. There are registered in the Department's project records 2,542 intramural projects, and 6,312 extramural projects. Thus, the ratio of extramural to intramural is approximately 2.5 to 1; however, of the extramural projects, 6,088 are Federal grant projects at State agricultural experiment stations. The Federal grant projects are coordinated and reviewed by the Department's State Experiment Stations Division, and in this way there is a close tie in with the Department's intramural projects. Using the ratio of 2.5 to 1, if the intramural projects were not registered, approximately two-fifths of the Department's research would not be reported to the BSIE. It should be noted that the above figures are total figures and include physical, agricultural, engineering, and social sciences, as well as biological science. However, in our letter of August 1, 1960, on biomedical research, the ratio of extramural to intramural was approximately the same, so we feel this is a representative relationship for the biological sciences.

The Department recognized some 15 years ago the need for a system to coordinate its research activities and developed a highly effective one. The information from this system is available to cooperators and interested parties; that is, Government agencies, State agencies, industry, private foundations, and others. For this reason the Department's present thinking would be that the BSIE should organize its services so as to be all-inclusive in the biological science field.

Experience has shown that the designing of systems and procedures to implement interagency coordination should be approached with caution and patience. It is essential to avoid procedures that would add appreciably to the scientists' present burden of reporting and answering inquiries.

2. Observations on basic research by the Department of Agriculture in relation to similar research by the National Science Foundation.

For several years the Department has recognized the urgent need for basic research in the agricultural field, including research the Department is doing in the biomedical area. Even though the amount of basic research conducted has been materially increased by both the Department and State experiment stations, it still is not adequate to fulfill the needs. Therefore, the research grant support given to agricultural scientists to conduct basic research by the National Science Foundation is apropos. Should there be a sizable increase in funds for basic research the problem of coordination would become more complex. At the present time the Department does not feel the problem is at all serious. The National Science Foundation grant program and the Department's intramural and extramural program supplement and complement each other.

3. A brief summary of the use by other agencies of biomedical data available from USDA household consumption surveys.

(*a*) Relation of food consumption to disease—through study of the correlation of amounts of foods and nutrients in diets of families in different regions with incidence of heart disease (National Heart Institute), of cancer (National Cancer Institute), and of susceptibility to rheumatic heart disease (a private medical college).

(*b*) Estimation of the ratio of strontium 90 to calcium in the average U.S. diet and in diets in different regions (Division of Radiological Health, Public Health Service).

(*c*) Determination of tolerance levels for chemicals in foods. For many years, the Food and Drug Administration has used USDA household survey data to determine average and high consumption of foods in setting tolerance levels. Survey data were also important in determining the need for enrichment of bread and flour.

4. An indication as to the current usage of the two files on current projects maintained by the Department of Agriculture:

(*a*) *Central Project Office file—Central Project Office (average 1958–59)*

[Number of requests per year]

Person or agency seeking information	Information obtained by—			Total
	Personal inspection of CPO files	Written material prepared by CPO	Verbal report given by CPO [1]	
United States Department of Agriculture:				
Research workers	34	11	25	70
Research administrators	6	14	20	40
Others	13	17	20	50
Total	53	42	65	160
National Institutes of Health	1	1		2
Public Health Service (HEW)		2		2
Other Federal agencies	4	2		6
State agricultural experiment stations	1	2		3
Private firms	1	3		4
Congressmen and congressional committees	1	1		2
Foreign agencies		1		1
Other	1			1
Total	62	54	65	181

[1] Usually by telephone.

The requests summarized in the above table include only those where the requester was seeking information on the nature, status, leadership, and location of current Department research activities. It does not include inquiries about the functions and facilities of the Central Project Office nor inquiries by research divisions relating to procedural and housekeeping matters. Information on the nature and status of research is obtained from the written descriptions of approximately 3,000 current projects and from annual reports of progress on such projects. Some of the requests handled by CPO require extensive searches of the subject-matter file, and the preparation of carefully organized reports; other inquiries may be answered by brief searches and verbal reports.

The Central Project Office was established mainly to assist administration and coordination of research within the Department and its forms and procedures are designed accordingly. While the information services of CPO are

available to other Federal departments, there have been no extensive efforts to advertise such services. And, since a major part of the Department's research is applied research aimed at problems of the farmer, other Federal agencies have shown only limited interest in it.

Informational services provided by CPO to persons and organizational units within the USDA go far beyond what is indicated by the table. Every time a new or revised project is proposed a project description covering the proposal is circulated by CPO to all Department units doing related work and also to the professional staff of the State Experiment Stations Division, ARS. These agencies are asked to comment on all project proposals and significant suggestions or comments by them must be reconciled before a project can be approved. Thus, proposed projects are usually circulated for information within the Department on a directed basis rather than on a request basis.

(*b*) *State experiment stations file—State Experiment Stations Division, 1960*

[Number of requests per year]

Person or agency seeking information	Information obtained by—			Total
	Personal inspection of SESD files	Written material prepared by SESD	Verbal report given by SESD [1]	
U.S.D.A.:				
Research workers	39	89	151	279
Research administrators	10	11	30	51
Others	5	11	12	28
Total	54	111	193	358
National Institutes of Health		1	2	3
Public Health Service (HEW)			13	13
Other Federal agencies	5	16	19	40
State agricultural experiment stations	30	231	170	431
Private firms	3	23	22	48
Congressmen and congressional committees		28	4	32
Foreign countries	29	10	6	45
Other	1	11	7	19
Total	122	431	436	989

[1] Usually by telephone.

The project office of the State Experiment Stations Division was established in 1906 to assist in the administration of the Adams Act of that year. As the Federal-grant program has grown over the years, the number of projects has increased. At present, records are kept on approximately 6,000 Federal-grant projects. These records include information on the specific nature of the research being engaged in; the names of the persons conducting the research; the specific amounts of the current financial support for the research; cooperation, when another agency participates in the research; and classification according to subject for cross-reference. When projects have been activated for more than a year, the record includes the annual progress reports; the publications credited to the project; and the expenditures for each fiscal year since activation.

The following are questions which are typical of the inquiries answered from the project records:

How much was spent last year on sheep research at the State experiment stations?

What research is being done on the marketing of dairy products?

Who should be contacted in a given State for information on its cereal crops research?

What States are conducting research on hog cholera?

What are the names and addresses of persons doing potato-breeding studies?

Is any research being conducted by a given State on insects affecting apples?

Is any work being done on the processing of cantaloup?

How many workers are engaged in animal disease and parasite research?

The requests summarized in the foregoing table were of this nature. As might be judged from studying these questions, some inquiries require extensive searching and organization for ascertainment of the information needed while

others may require only a few moments of time. The data given in the table represents the use made specifically on the Federal-grant projects. In addition, SESD has titles on approximately 7,000 non-Federal projects at State agricultural experiment stations.

Information on the Federal, Federal-grant, and non-Federal projects provides for coordination within the total area of agricultural research.

NUTRITION AND HEART DISEASE

Senator HUMPHREY. Before concluding with the Department of Agriculture, I should like to be very specific as to what we mean by interrelationship of agencies' interests.

Earlier, I referred to problems common to the National Heart Institute and the Department of Agriculture. Let me cite now excerpts from an article in the authoritative "AMA Archives of Internal Medicine." The article points up the two-way relationship of heart disease and nutrition.

NEED FOR INDEXING IN DEPTH

The reader of this article might rightly ask: Do researchers specializing in heart disease know about all the current related work of nutritionists who do not specialize in heart disease or perhaps in any other disease as such and who do not entitle their projects with any specific reference to heart disease or anything apparently resembling it? Yet the nutritionists may actually be working on the effects of deficiency in, let us say, thiamine or protein or potassium or some other element in a diet which may be highly significant to the cardiac and the cardiac specialist.

What I am saying, in effect, is that only by utilizing indexing in great depth can two specialists in two apparently different fields whose current work is interrelated be brought together, so to speak.

The excerpts from the article follow:

EXHIBIT 23

EXCERPTS OF ARTICLE ON HEART FAILURE AND MALNUTRITION

HEART FAILURE AND MALNUTRITION

Heart disease and heart failure have had various effects on the patient's state of nutrition, and it must be noted that some forms of malnutrition produce myocardial insufficiency, says Dr. Louis Leiter, who adds that the mechanisms by which these relations are established are unknown.

Among the several ways in which heart failure may lead to nutritional deficiency are the necessity to restrict the patient's activity or confine him to bed; psychologic influences that result in lack of appetite; the appearance of iatrogenic or pharmacologic factors that may produce anorexia and gastrointestinal distress (the unkindest cut of all is the low-salt diet); and metabolic changes in tissues and organs, which probably have nutritional impacts of varying duration and degrees of reversibility. Also, heart failure contributes to malnutrition by loss of plasma protein in removed ascitic and pleural fluid and, at times, in proteinuria.

The heart and its function may be disturbed by such nutritional influences as thiamine deficiency; nutritional anemias, including pernicious anemia; protein-deficient diets; potassium deficiency, which eventually can lead to myocardial degeneration and fibrosis superimposed on the common etiological types of heart disease; and, possibly, excesses or deficiencies in calcium and magnesium, which may lead to organic or functional changes. * * *

Prophylactic maintenance of adequate nutrition is particularly important in the cardiac patient in the earlier stages of failure. It would indeed be helpful, and it is possible to make all but extreme low-sodium diets both palatable and

adequate in the essential nutrients. (A.M.A. Arch. Int. Med. 105: 825, June 1960.)

ELECTRONIC DATA PROCESSING METHODS

Senator HUMPHREY. At this point I think it would be well if we get an observation or two from the National Science Foundation and its Director of the Science Information Service, with whom we have worked before. May I say it has been with good results and splendid cooperation. Dr. Burton Adkinson is an expert in the electronic method of storage and retrieval of documented, that is, published information, which, as has been indicated, is a category in itself as compared to what the BSIE has been doing.

I would like to ask this question of you: What do you regard as the possibilities for mechanical print-outs from a Government-wide index of research projects in the life sciences? I use this phrase, "print-out" or "write-out," meaning a series of publications to be printed by machines rather than manually, and to report on categories of current research projects amongst the various agencies.

Dr. ADKINSON. The technology is available; that is, the mechanical equipment is available for print-out now. It is being used in many agencies for purposes other than this. But you have to develop a system for organizing the information so that you can print it out in the arrangement that you want it. I think that the BSIE made a first step when they went from the straight punchcard to the Burroughs system. We are quite interested in getting a listing, and it will take some more systems study before we can get this. We have been in negotiation with BSIE and other agencies regarding listings in physical sciences and the biological sciences. It is going to take some more work before we can get this, but the technology is here.

It is a case of getting the system.

Senator HUMPHREY. As I understand it, Dr. Adkinson, this is your responsibility, is it not, to coordinate this whole business?

Dr. ADKINSON. Yes.

Senator HUMPHREY. Of the machine operation for indexing, retrieval, and cataloging, and so forth?

Dr. ADKINSON. This is what we are trying to do, sir, and we accept that responsibility; yes.

Senator HUMPHREY. That responsibility was placed upon you about 3 years ago, as I recall.

Mr. REYNOLDS. Under the National Defense Education Act.

Dr. ADKINSON. And the Executive order; yes, sir.

Senator HUMPHREY. And are you working now in close cooperation with BSIE on this?

Dr. ADKINSON. We are, sir. We have been for the past 2½ years.

SEPARATE TABULATION ON CANCER CHEMOTHERAPY

Senator HUMPHREY. In the Cancer Chemotherapy National Service Center data processing project, have you worked with them?

Dr. ADKINSON. Very little, sir. We have kept track of what they are doing. It is a highly specialized service.

Senator HUMPHREY. Yes.

Dr. ADKINSON. Oriented to a particular use, and we felt that the agency that set it up knew what it wanted, and it is doing the job.

We cannot centralize all this kind of information activity. The agencies must have information services responsive to their particular need.

Senator HUMPHREY. I was not speaking so much of the centralization as I was of the consultative process.

Dr. ADKINSON. Yes.

Senator HUMPHREY. In reference to their activities.

Dr. ADKINSON. We are aware of it and have been following it.

Senator HUMPHREY. And it has done quite well, has it not?

Dr. ADKINSON. Yes, it has.

Senator HUMPHREY. This is a particular discipline in which coordinated indexing and data processing have worked out fairly well.

POSSIBLE SPEED OF PRINT-OUT OF INFORMATION

Senator HUMPHREY. Before we leave this matter of technological developments, I want to emphasize this fact. From what this committee and subcommittee have heard today and earlier, technological breakthroughs have made the process of information retrieval and print-out far simpler than most scientists may realize.

So there is no reason to proceed by "horse and buggy" methods or by quill pen or sorting of 3 by 5 index cards. Systems are right now being devised which can sort, retrieve, and print out information with lightning speed. In this regard, there will appear in the record, two pages from a bulletin describing the forthcoming handling of information by the Armed Services Technical Information Agency. One of the key points of its future system will be that ASTIA will be able to print out information of a bibliographic or other nature at the rate of 600 lines per minute. That can represent a tremendous boon to science.

Now ASTIA is, of course, a vast assembly-line system for documentation, including documents which are progress reports. ASTIA and the Office of Technical Services are relatively unique; but other agencies can afford to learn from their experience.

The exhibit follows:

EXHIBIT 24

EXCERPTS FROM REPORT, "AUTOMATION OF ASTIA"—A PRELIMINARY REPORT, DECEMBER 1959, PAGES 19, 20

D. CUMULATIVE INDEXING AND TAB PREPARATION

Mechanized cumulative indexing.—Proper utilization of the technical information store maintained by ASTIA demands both prompt announcement of availability of new information, and adequate, easily used reference keys.

The ASTIA announcement function is provided for by the Technical Abstract Bulletin issued on a twice-monthly cycle, announcing newly acquired reports on the average of 60 working days after receipt. Ultimately, under the automated system the aim is to reduce this to 20 to 25 working days.

The entries in TAB are listed in sequence by subject division of the ASTIA Distribution Guide. This in itself acts as an adequate means of discrimination to guide the user in the initial perusal of each individual bulletin. A numerical index to each issue is included for added convenience.

The subject and corporate author indexes will be eliminated from the individual issues of TAB and in their place a Quarterly Cumulative Index will be published for the first three quarters of each calendar year. At the end of the fourth quarter an annual cumulation will be published.

These cumulative indexes will increase the scope of service to the ASTIA user, and should reduce the volume of unidentified requests. The indexes will also

allow the engineer or the scientist, personally if he so desires, to conveniently and easily seek out required technical information. This should also enable him to discriminate more accurately and precisely in the selection of required information.

The cumulative indexes will be compiled by subject matter and by corporate author and referenced to AD number, TAB issue, and the appropriate division in the ASTIA Distribution Guide. These indexes will be prepared from the card files prepared for input to the retrieval term file, master index, and inventory files. Punched-card decks used to update the master inventory file during each semimonthly cycle will be retained and used to print out the numerical index for the corresponding issue of TAB. This group of cards will be gang-punched with the TAB issue number. The group already contains the division and section of the Distribution Guide. The originating agency code will be transferred from the punched cards used to update the master index file. Selected groupings of the retrieval terms will be utilized for subject accumulations for indexes. The punched cards used to update the retrieval term files for six TAB cycles (quarterly) will be run against the numerical index card decks to pick up TAB issue number and division listings. The card decks will then be utilized to print out repro copy for the cumulative indexes.

A simpler procedure for providing proper and complete service to new contractors of the Department of Defense as well as those entering new fields of activity is desired. The problem is magnified in that back issues of ASTIA's announcement publications are not available for distribution. Also, prior to September 1957, the announcement publications did not carry abstracts. Thus it is difficult to satisfy new users with broadly defined technical information requirements.

The preparation of a form of cumulative TAB, at least for the AD collection (documents cataloged since March 1, 1953) offers the most practical solution to the problem.

Issuance of TAB and bibliographies prepared photographically from catalog cards and of subject and corporate author indexes covering the AD collection has been considered by ASTIA. Thus far, producing such publications in this manner has been determined to be too costly and beyond ASTIA's available resources.

As previously discussed, it is planned to employ punched-paper-tape devices to convert cataloging and abstracting data into machinable form while preparing reproduction copy for TAB. By converting the paper tape to magnetic tape, ASTIA can employ the 600 line per minute high-speed printer to produce repro copy for TAB and bibliographies at comparatively low cost. It is recognized that the difficulties imposed by the limitation of characters available in existing computers and printers must be overcome before full effectiveness can be achieved in this area.

Consideration is also being given to converting into machinable form all of the cataloging and abstract information for the entire AD collection. It is hoped that this can be completed by contract on schedule with the installation of the USS–90 Tape-Randex configuration. This would give ASTIA considerable flexibility in compiling announcement and reference information. Any selection or grouping of reports or references to reports in the AD collection could be compiled and indexed mechanically. As ASTIA gains experience in the rapid response information service, new concepts are bound to develop.

BIO-SCIENCES INFORMATION EXCHANGE

Senator HUMPHREY. Now, I am going to turn to Dr. Deignan. We have been talking of your establishment considerably and so far you have fared fairly well. You are the head of the Bio-Sciences Information Exchange, are you not?

Dr. DEIGNAN. I am the Director of it.

Senator HUMPHREY. Would you mind telling us what developments you see and how you feel you are coming along with your work? Might I put you in the frame of reference of Dr. Irving of the Department of Agriculture?

Dr. DEIGNAN. Yes; I will be very glad to do that. The reason I ask to speak, Senator Humphrey, is because I think we have not got

quite clear the functions of the Bio-Sciences Information Exchange. It was established primarily by the Government agencies making grants and contracts to keep each agency informed of the other grants, contracts, and applications in its particular area and in other areas. The extension of the Exchange into the matter of information storage and retrieval from a subject standpoint is what we regard as a very fortunate outgrowth.

I am very grateful to you for increasing the information that is registered with the Exchange.

We were established at the direction of the Subcommittee on Scientific Information of the Interdepartmental Committee on Scientific Research and Development, which met in April 1950—and Dr. Cushing was a member of that committee at that time.

The reason I am going back instead of answering your question directly is because as things have developed around the table today, we have been more concerned with the information and storage of scientific information than with the accounting of the research grants of different agencies.

I would like to go back just a little further and say that while there are many high level arrangements like the Federal Council and other things we have talked of around this table today, Dr. Cushing, Dr. Dunham, Dr. Musser, Dr. Wilson have all been members of the Governing Board of the Bio-Sciences Information Exchange, and in that capacity have assisted in directing the policies of exchange of information among these granting agencies.

EVOLUTION OF THE EXCHANGE

I just happen to be personally a very, very firm believer in evolution and not in revolution, and I have tried quite hard in the Bio-Sciences Information Exchange, to produce, and through the products of the Exchange, to stimulate an interest in the subject information which, except in a very broad sense, is actually not a part of our function.

But I believe very deeply, having come from a research center where there was no money available for research at the time I came to Washington, that Federal money should be well spent—should be available to people in universities. And so I have endeavored to keep a history of every research grant that has come to our knowledge.

Now, from this we have expanded into the intramural area on a purely voluntary basis.

Senator HUMPHREY. Wait a minute. I realize you have expanded on a purely voluntary basis, but this is the point. There is no holy writ that says that optional registration should be the way.

Dr. DEIGNAN. No.

POSSIBLE CRITICISMS OF ALLEGED DUPLICATION

Senator HUMPHREY. There are vast amounts of money being expended in the intramural activities of these agencies and what Senator Humphrey is worried about, as a friend of research, is that one of these days somebody around here is going to find out, or think he has found out, that you people may not know what is going on in all of the other agencies in current research. They are going to come up with facts on one or two projects that somebody else is doing,

and you did not know it and it will be all over every newspaper in the country. Then all of the work that we have attempted to do to expand in the field of medical research may be threatened out of what some might term demagoguery or out of some unintentional distortion of the total picture.

I am a great believer in preventive medicine.

Dr. DEIGNAN. So am I.

Senator HUMPHREY. I want to make sure that somebody does not find, you see, a gopher in the zoo and say that we have got to close up the zoo because there are gophers, or somebody does not happen to find a weed in the flower garden and say we have got to destroy the flowers.

NO DIRECTIVE ON INTRAMURAL REGISTRATION

Dr. DEIGNAN. I wholly agree with that and I am terribly grateful for the large amount of intramural information that has come to the Exchange. But I cannot say that I feel that someone has been remiss in not giving us information on an intramural program because our charter, as set up under the direction of the interdepartmental committee, said intramural research should be registered on a voluntary basis.

So we have carefully asked for it to enlarge our general body of information, but there has been no directive that the BSIE should include intramural research.

Senator HUMPHREY. Let me ask you, Dr. Deignan, do you think it would be helpful if a directive could be issued or should be issued to provide the intramural information to BSIE?

Dr. DEIGNAN. I would like to say I think it would be extremely helpful to have this information because I do believe in BSIE as a means of finding who is working on what.

I do not think that this single source of information should ever become the only source of information.

Senator HUMPHREY. No.

Dr. DEIGNAN. I think it is purely supplementary to what goes on in other information exchanges, such as direct contacts among scientists, through their own scientific societies and through their own meetings. But I think it provides an extremely useful background to help people to know who else is currently working on the same problem.

VALUE OF MULTIPLE APPROACHES

Of course, I could never say that I think even 12 people working on exactly the same problem is a duplication of scientific effort.

Senator HUMPHREY. Nor would I—I want to make that quite clear.

Dr. DEIGNAN. I do not think we would ever have reached what we have in the poliomyelitis situation if the National Foundation for Infantile Paralysis had backed only one man. Just think how many people were seeking an immunizing agent in polio and one man broke through. It might quite easily have been any one of the others, but the one with the greatest effort perhaps, or maybe more money to work with, reached the goal first. So I do not think that we can say that we should support only one project. I think we need every idea, even if it means several people working on the same problem in the same way.

Senator HUMPHREY. That is agreed. I appreciate the viewpoint of scientists on the need for multiple approaches and multiple sources of support.

One of the most eloquent expressions on this concept which I am glad to call attention to, at this point, came from Dr. John H. Heller, of the New England Institute for Medical Research, with whom we have been in contact. After a spirited statement on the need for greater congressional understanding of basic research, he states [3] very frankly:

> Even after some legislators have begun to grasp the importance of research, they seek to avoid increasing research funds and suggest, "How about putting all basic research under a single agency? Then we wouldn't have any waste or duplication of research effort." To this there is only one reply. "If you want to avoid so-called duplication of research effort, then let us remove every cancer investigator in the United States, except one man. If two are doing cancer research, this is duplication of effort." Naturally, this is idiotic. In the face of the unknown, the more pioneers that attack the frontier, the better chance there is of discovery and breakthrough. Furthermore, if there were a single agency controlling all funds, a single fallible man in charge of a particular division might not think that a certain problem submitted to him for support was worth supporting. Scientists would then have no other recourse. Currently, the way things are set up with multiple programs (although each agency knows what the other is doing), if one agency turns a project down owing to lack of interest or possible shortsightedness, there are others who may pick it up. Many worthwhile projects brought to successful conclusion have been turned down by several agencies before one has finally undertaken support. A bureaucratic control of science would be impossible. Even the Russians know this; and in a land where there is bureaucratic control of virtually everything, the one area which tends to get hands-off treatment is science.

SUPPORT OF BASIC RESEARCH

Senator HUMPHREY. But this subcommittee has been asking, "How can we be sure that every agency knows what the other is doing?"

As to the proposition of supporting basic research itself, my record and that of this subcommittee stand out clearly on behalf of fullest support for basic study and for multiple efforts in it. My comments on basic research are spelled out in our seventh print, "The National Science Foundation and the Life Sciences." Basic research has, for too long, been given too low a priority and too low a proportion of Federal funds. But evidence before this subcommittee suggests that every agency does not know what every other agency is doing in basic or in applied research.

PLANNING IN APPLIED RESEARCH

And it is, as regards applied research, that I emphasize that we try to arrive at our goal by some reasoning, knowing process rather than by accident. Let me put it this way: I think the point has been well made here that it is not duplication to have a substantial number of people doing the same research or at least trying for the same objective or even within the same general framework. But it would be better if somehow or another we sort of took a good look at it and said "here is an area in which we need to make a substantial investment," and to do this by some process of reasoning rather than say to just everybody who comes in, "Well, you are a good man, you have published some

[3] Heller, John H., "Of Mice, Men, and Molecules," Charles Scribner's Sons, New York, 1960, pp. 159–160.

material; you are a good scientist and you have a good reputation; so, go to it even though the field may already be far over-supported in terms of its potential significance."

(Discussion off the record.)

Senator HUMPHREY. I want to see the Government to the greatest possible extent utilize its resources through some process of calculation or judgment rather than the happy accident of good fortune or the happy good fortune of accident, maybe I should put it that way.

Dr. DEIGNAN. I wholly agree with that. I did not mean to argue against such an idea, but I think there are a lot of mechanisms of coordinating research efforts.

One of the things we attempt to do in BSIE is to foresee, by having staff members read literature, what seems to be a new concept that needs to be worked on, and we have often been prepared by bringing together information in some area long before a great interest in that particular area had developed among the granting agencies.

I only want to make the comment that we actually were established to provide the information on how many awards a man, an institution, or a department is getting, and that our depth of subject analysis is, in a sense, a byproduct which I am very proud of and very thankful to you for bringing to the fore, but we were not an information storage and retrieval center.

SEEKING IMPROVEMENTS IN INTERAGENCY PRACTICE

Senator HUMPHREY. Exactly. So that we may have a good understanding of each other's position, or reasonably so, I know that the work that has been done has been done well.

But I want to see this service utilized for more than the collection of administrative and budget-type reports.

I don't see how scientists can afford to ignore this service or fail to utilize it at its highest capacity.

NO SCIENTIFIC STUDY AVAILABLE ON SCIENTISTS' CONTACT

Now we have heard in many quarters that "expert scientists already know what is going on in their field; they know who is doing the important work, etc."

We are not questioning the fact that scientists do make every effort to keep up with what their colleagues are doing. We point out, however, that no one has made a scientific test as to exactly how much any group of scientists may actually know about current work in a particular discipline on the part of 10 or 20 or 100 colleagues in the same country and in different countries abroad.

We point out, too, that even if a scientist may be presumed to be in touch with far-flung work in his own field, it is important to keep up with what scientists are doing outside a given field, but relevant to it. It is obviously extremely difficult to do so, with perhaps hundreds and hundreds of projects going on in related fields.

Moreover, if a senior scientist finds it comparatively easy to keep up with distant colleagues whom he has known and met and with whom he has corresponded, then it is far more difficult for a junior scientist to do so. And if it is difficult for a scientist to keep up with published

literature, is it not far more difficult to keep up with prepublication information, unless there is active and selective use of a mechanism such as the Bio-Sciences Information Exchange?

STUDY SECTIONS APPRAISE APPLICANTS' FAMILIARITY

I note that an analysis was made in May 1959 of NIH study section actions in order to determine the reasons for disapproval of research grant applications. It was found that a small percentage of the disapprovals, around 7.2 percent, were based on the "applicants' need to acquire greater familiarity with the pertinent literature."

Now, I assume that "pertinent literature" means, by definition, published literature. Published results are, of course, the most crucial type of information. But does anyone care as to whether or not an applicant has bothered to try to inform himself about pertinent prepublication work, e.g., through contact with BSIE? Such information is of far less significance obviously; but can it be ignored entirely?

FINDING OUT ABOUT NEGATIVE RESULTS

I cannot emphasize too strongly the importance of being able to ascertain whether an earlier project ended with negative results. Everyone recognizes how valuable so-called negative results can actually be. The problem as I see it is that many people do not realize how difficult it is to find out about negative results. They may largely go unreported, unpublished.

The fact is that we do not know to what extent articles in medical journals do or do not report negative results. We do not know what proportion of experiments end in so-called negative results. The question which we ask is: "If science has no reliable way of determining that a particular project existed in the first place (unless it uses a mechanism such as BSIE), how can one scientist ever communicate with another concerning the negative (or positive) results in that particular experiment?"

Will not scientist No. 2, lacking prior information, tend unwittingly to repeat the experiment which failed? While there may be and often is value in that, would it not be better to at least know that it failed the first time?

What I am urging is, in effect, planned efforts instead of unwitting efforts.

INITIATIVE IN IMPROVING SYSTEM

Key individuals in the Federal agencies should not just sit back if improvements are necessary in any system where taxpayers' money is being expended.

I have a feeling that people in the professions have a social obligation that, if they think there is something more that needs to be done, they should say so. I have been in the field of education and know

the timidity of teachers on the public platform in contrast to the grousing around in private conversation. They will say that we need this and we need that, but when they get out and face the school board or the public they say, "Well, this is an area where I ought not to get involved."

My theory is to do the opposite. The people that really ought to be involved are the people that know something about it. With all due respect to my colleagues, all of whom are much more expert in this than I am, I reiterate that none of us knows quite as much about these problems as those of you that are before us here today.

Therefore, I think it is your duty to take the cudgel up, and if you need something to be done, to say, "I need it done," and to go over and see the President if you have to, and say, "Look, we are wasting our time, our money and our energy not doing this." The Congress is the people's body or representative. We are not experts in retrieval, documentation and translation, but we are supposed to be receptive to the professional guidance of people such as yourself.

There is an old line in political science, experts are supposed to be on tap and not on top. I think that the experts in this field at least ought to be giving us the advice voluntarily. That is where we come back to BSIE and its original purpose. I agree with you. But since that time, Dr. Shannon has made the case, vast amounts of money are being expended, tremendous new areas have opened up in the field of science and technology and have caught all of us off base.

Therefore, it is the professional responsibility of people in these areas to say, "Look, Senators; look, Mr. President; look, Mr. Secretary, we have to do this or we are going to be caught," and not take the cozy position of saying, "Well, it was not really our responsibility," and everybody is being jolly, nice and sociable and using the right kind of soap and coming to us looking nice and we are all cooperative.

Very frankly, I am distressed. I think that if the BSIE has a service to perform in this immediate field of current research, and that is the one facing us first, then they ought to have data on these intramural projects. By contrast, when you were established, the volume of money in intramural research was penny ante stuff compared to what it is today. The whole volume of research was not a fraction as much as Dr. Shannon has today in NIH laboratories alone. So we are living in a different period. Those are my views. But you have done a great job.

Dr. DEIGNAN. I did not mean it in the sense of a final policy, but I did want you to see that we are growing in volume in intramural research. Dr. Elting of the Department of Agriculture sat at our last Governing Board meeting to consider bringing in the intramural work and the land-grant college work from the Department of Agriculture with us.

So I think we are expanding in that direction very rapidly.

REGISTRATION IN PHYSICAL SCIENCES

Senator HUMPHREY. Will you be able as a result of your experience, Dr. Deignan, to give us observations or guidelines on the proposed central index of the physical sciences research?

Dr. DEIGNAN. I do not feel that it is quite my position to do it. You mean as to how it should be done? I feel, Senator, that that should be done by the physicists. There have, as you know, been conversations on combining the Physical Sciences Information Exchange with the Bio-Sciences Information Exchange. A Science Information Exchange [4] may be formed, in my personal opinion, but the approach is that we would need a really topflight physicist to contact those divisions of Government concerned with the physical sciences to find out the needs of the physical sciences and on that basis develop the type of information which would be useful in physical sciences.

Now, we have precedent for this because when we started in the biosciences we were actually the Medical Sciences Information Exchange. As we developed, we took in the psychological sciences. Before we developed or attempted to develop any form of indexing in the psychological sciences, we engaged an able psychologist who contacted the people in the granting divisions of the Government which were supporting psychology, and with their help we developed a system which we felt was helpful to them.

I would hope that we would use the same system for the physical sciences. I have no apology for our techniques; and I do want to bring out that in recording information on who is doing what, it is done in one way if you are indexing only and in another if you are coordinating the indexing day by day with a record of how many dollars are granted and what days certain projects end. If you could just say, "Why, all these projects are associated with this given topic," it is a very different kind of system from that you use if you say how much money is being spent on the 1st of August and how much is being spent on the 1st of September and you have to change the records during that time.

These are among the factors which I think will determine how any new body of information would be brought in and how it should be made available.

VALUE OF BSIE "BIG PICTURE"

Senator HUMPHREY. Before concluding with Dr. Deignan, I should like to reiterate that the subcommittee has found invaluable certain articles which she has written in professional journals and certain analyses prepared by the Bio-Sciences Information Exchange in response to our requests.

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[4] NOTE.—On September 22, 1960, there was announced the text of an interagency agreement in the form of a revised charter which reconstituted the Bio-Sciences Information Exchange within what is now termed the "Science Information Exchange."

Under this newly named organization, services will be performed in the future for the physical, mathematical, engineering, and social sciences as heretofore have been performed only for the biomedical sciences.

A separate treatment of problems in connection with registration of data in the physical sciences will be found in a forthcoming committee print by the Subcommittee on Reorganization and International Organizations.

Indeed, I think that it would be fair to state that the subcommittee could hardly have hoped to develop expeditiously the comprehensive type of presentation which I believe we have worked up, had it not been for assistance from Dr. Deignan in the form of BSIE's statistical analyses. Only with such aid have we been able to develop promptly what I call the big picture of Federal biomedical research.

Supplementing some of the earlier figures which we have cited, I will ask that the record show at this point several of the extremely helpful responses by BSIE to our inquries.

We will start with the Exchange's reports elaborating on the magnitude, variety, and distribution of Federal biomedical research. Several of these reports were of course developed by Dr. Deignan as part of BSIE's standard reporting to the agencies.

EXHIBIT 25

ANALYSIS IN MARCH 1960 BY BIO-SCIENCES INFORMATION EXCHANGE INDICATING YEAR-BY-YEAR TOTALS OF SUPPORT OF BIOMEDICAL RESEARCH BY U.S. GOVERNMENT AND OTHER SOURCES

TABLE I.—*Support of investigative research in the biosciences,*[1] *fiscal years 1946 through 1959*

Year	Government		Non-Government		Total	
	Number of grants	Amount	Number of grants	Amount	Number of grants	Amount
1946	131	$1,871,065	394	$2,436,376	525	$4,307,441
1947	416	5,807,147	581	4,447,193	997	10,254,340
1948	1,051	12,859,975	1,014	8,597,772	2,065	21,457,747
1949	1,441	19,466,388	1,362	13,663,730	2,803	33,130,118
1950	2,052	21,320,493	1,265	11,680,377	3,317	33,000,870
1951	2,125	21,785,603	1,091	11,108,006	3,216	32,893,609
1952	3,022	34,533,220	1,247	13,653,342	4,269	48,186,562
1953	3,558	40,234,918	1,375	15,760,368	4,933	55,995,286
1954	4,498	50,313,353	1,517	16,566,572	6,015	66,879,925
1955	5,058	56,270,606	1,635	20,076,919	6,693	76,347,525
1956	5,849	70,405,593	2,118	24,555,007	7,967	94,960,600
1957	8,754	111,794,647	2,095	24,516,441	10,849	136,311,088
1958	9,993	137,901,673	2,417	33,302,659	12,410	171,204,332
1959	12,594	187,444,483	2,486	31,536,766	15,080	218,981,282

[1] The statistics in this table represent only those research grants and contracts registered with the BSIE by national granting agencies.

EXHIBIT 26

ANALYSIS IN MAY 1960 BY BIO-SCIENCES INFORMATION EXCHANGE OF ORDER OF MAGNITUDE OF FEDERAL SUPPORT OF MAJOR MULTIPLE SUBJECT CATEGORIES

TABLE IX.—*Order of magnitude of support of selected major multiple subject categories—Amounts from all sources* [1]

Dollars in millions	1957	1958	1959
36–37			Cancer.
35–36			Psychology and psychiatry.
34–35			
33–34			
32–33			
31–32		Cancer	
30–31			
29–30			
28–29			
27–28			Metabolism and metabolic diseases.
26–27	Cancer		
25–26			
24–25		Psychology and psychiatry; metabolism and metabolic diseases.	
23–24			Problems of children; nervous system.
22 23	Metabolism and metabolic diseases.		Cardiovascular system.
21–22			
20–21			
19–20			
18–19			
17–18	Psychology and psychiatry	Cardiovascular system	Infectious diseases.
16–17			
15–16	Cardiovascular system	Problems of children	Radiation effects and usage; urogenital system.
14–15		Infectious diseases	Blood.
13–14		Nervous system	
12–13	Infectious diseases	Blood	Endocrine system.
11–12	Nervous system	Radiation effects and usage	
10–11	Blood; problems of children	Endocrine system	Epidemiology; basic biology.
9–10		Urogenital system	Heredity and genetics.
8–9	Urogenital system		Surgery; digestive system.
7–8	Endocrine system		Deficiency diseases and nutrition; injury and shock.
6–7	Injury and shock	Injury and shock; heredity and genetics; deficiency diseases and nutrition; epidemiology; digestive system; basic biology.	Sensory organs; musculoskeletal system; respiratory system; sanitary engineering.
5–6	Deficiency diseases and nutrition; digestive system.	Surgery; respiratory system; musculoskeletal system.	
4–5	Respiratory system; musculoskeletal system; ecology; surgery.	Sensory organs	Public health; agriculture.
3–4	Sensory organs; sanitary engineering.	Public health; sanitary engineering; dental research.	Dental research; aging; toxicity and poisoning; ecology.
2–3	Dental research; biological effects of environment; public health; toxicity and poisoning.	Aging; toxicity and poisoning; biological effects of environment; agriculture; integumentary system.	Immunity; integumentary system; allergy; biological effects of environment.
1–2	Integumentary system; aging; allergy; ecology.	Allergy; morbidity and mortality; ecology.	Morbidity and mortality; nursing; oceanography; rehabilitation.

[1] The statistics in this table represent only those research grants and contracts registered with the BSIE by national granting agencies.

EXHIBIT 27

EXCERPT FROM LETTER OF MAY 19, 1960, FROM BIO-SCIENCES INFORMATION EXCHANGE ON NUMBER OF FEDERAL BIOMEDICAL RESEARCH PROJECTS, INVESTIGATORS AND RECIPIENT INSTITUTIONS

REQUEST 1—"OVERALL STATISTICS OF BIOMEDICAL RESEARCH"

(1) Number of projects registered:

Current projects in March 1960

Total	30,012
Extramural	18,107
Government	13,671
Nongovernment	4,436
Intramural	11,905
Government	11,735
Nongovernment	170

(2) Number of investigators (total, approximately 92,000):

Number of different investigators in approximately half the BSIE investigator file[1]

	Government support only	Nongovernment support only	Support from both government and nongovernment	Total
Principal investigators	12,366	5,343	2,361	20,070
Other professional personnel	19,865	3,294	2,822	25,981
Total	32,231	8,637	5,183	46,051

[1] All investigators with last names beginning with A through L. Total is based upon twice this figure.

(3) Number of recipient institutions:

Total	3,699
United States	2,717
Foreign	982

EXHIBIT 28

MEMORANDUM OF JULY 25, 1960, FROM BIO-SCIENCES INFORMATION EXCHANGE LISTING AMOUNTS AWARDED BY MAJOR MULTIPLE SUBJECT CATEGORIES

BIO-SCIENCES INFORMATION EXCHANGE,
Washington, D.C., July 25, 1960.

OFFICE MEMORANDUM

To: Mr. Julius N. Cahn, Director, Medical Research Project, Subcommittee on Reorganization and International Organizations, Committee on Government Operations, U.S. Senate.
From: Stella Leche Deignan, director.
Subject: BSIE table 560.

The attached table represents the subject distribution, by selected major multiple subject categories, of the grants and contracts registered with the BSIE by its supporting agencies for awards with beginning dates in fiscal 1959.

Under the BSIE system a total for all categories cannot be obtained, as the same project may be included in several.

Intramural projects are not included.

These figures do not provide an analysis of the program of any single agency; they simply compare the awards of the several agencies from one point of view.

Amounts awarded major multiple subject categories by agencies supporting Bio-Sciences Information Exchange—Fiscal year 1959

BIOLOGICAL AND MEDICAL SCIENCES

Subject	NIH		Army		Navy		Air Force		AEC		NSF		Other Government		Total	
	Grants	Amounts	Grants	Amounts	Grants	Amounts	Grants	Amounts	Grants	Amounts	Grants	Amounts	Grants	Amounts	Grants	Amounts
Accident	19	$764,697	6	$260,807	2	$35,000									27	$1,060,504
Aging	130	2,719,941	1	32,269	1	5,000			5	$213,167	2	$22,800	8	$217,997	147	3,211,174
Agriculture	140	1,627,991	2	52,484	8	39,048			61	1,183,510	89	673,796			300	3,576,829
Allergy	128	1,875,452	5	120,582	3	18,355					2	26,200			138	2,040,589
Anesthesia and analgesia	44	540,413	9	146,753	1	38,380			1	20,000					55	745,546
Animal reservoirs and vectors	106	1,093,222	9	184,835	3	50,802					8	64,899			126	1,393,758
Anthropology	70	1,155,160	2	17,525	3	24,988	1				25	225,929	2	28,483	103	1,452,085
Banks	4	44,663							3	102,023					7	146,686
Basic biology	380	3,410,657	4	36,066	101	611,201	6	$50,101	47	738,525	744	4,650,956	4	81,336	1,286	9,578,842
Biological effects of environment	48	846,264	17	325,670	26	232,963	15	300,575	7	234,955	4	26,267	2	38,200	113	2,004,894
Blood	668	10,981,895	71	1,413,630	17	186,897	3	62,712	22	470,386	21	224,566	3	23,169	805	13,363,255
Body temperature	63	843,444	13	189,090	5	35,643	1	13,647			4	37,300			86	1,119,124
Cancer	1,506	27,295,896	4	51,674	5	23,355			42	831,069	7	77,150			1,564	28,279,144
Cardiovascular system	1,162	17,570,247	40	672,910	22	183,461	14	193,277	7	154,325	8	55,450	5	139,539	1,258	18,969,209
Deficiency diseases and nutrition	329	4,896,812	48	1,177,117	14	61,394			11	123,043	21	174,304			423	6,432,670
Dental research	339	3,520,496	22	219,174	17	129,127	3	56,863					1	20,779	382	3,946,439
Digestive system	527	6,713,099	40	710,126	6	21,987			17	143,859	24	204,858	1	17,941	615	7,811,870
Ecology	73	818,243	2	15,480	25	116,160			26	706,815	228	1,406,679			354	3,063,377
Endocrine system	698	9,708,856	14	268,316	16	143,583	6	104,616	24	379,818	59	426,909			817	11,032,098
Epidemiology	287	8,942,952	26	648,081	2	50,802			3	52,325	1	2,700	3	209,300	322	9,906,160
Experimental embryology	114	1,223,881			2	6,200			8	93,782	43	293,775			167	1,617,638
Followup	276	6,966,649	9	56,742	1				6	159,784			24	626,044	316	7,809,219
Heredity and genetics	359	5,549,925	10	394,630	20	103,636	2	81,680	63	1,106,279	183	1,376,050			637	8,612,200
Hospital and medical facilities and administration	52	1,605,635											4	96,020	56	1,701,655
Infectious diseases	764	10,807,987	105	2,524,986	33	162,225			9	137,554	23	221,707	2	143,225	936	13,997,684
Injury and shock	144	2,396,569	70	1,533,176	24	246,909	6	257,160	72	2,970,672	2	11,325	2	53,077	320	7,468,888
Integumentary system	117	1,519,677	18	419,339	8	57,279			7	108,883	6	46,954			156	2,152,132
Intoxication and drug addiction	18	340,938	1	18,276	1	38,380							3	64,272	23	461,866
Lymphatic system	73	1,041,485	2	55,981	1	6,486			1	25,000	2	18,384			79	1,147,336
Metabolism and metabolic diseases	1,288	20,061,570	56	1,099,843	28	239,505	6	118,511	68	1,096,072	101	917,570	2	165,272	1,549	23,698,343
Morbidity and mortality	60	1,599,725	4	182,550							2	33,200			66	1,815,475
Musculoskeletal system	296	4,146,197	8	108,614	17	76,129	2	12,000	16	202,681	19	173,986	4	105,075	362	4,824,682
Nervous system	944	17,988,688	14	224,494	30	338,258	45	481,908	13	227,032	61	588,846	20	476,021	1,127	20,325,247
Nursing	48	1,256,721											1	8,560	49	1,265,281
Occupational diseases	31	677,783			3	41,000	1		2	165,353			1	35,022	38	919,158
Oceanography	10	117,707			21	113,344			11	392,322	32	369,172			74	992,545
Physiological and psychological stress	105	1,720,813	18	314,607	15	134,068	10	145,804	4	52,183	5	43,542			157	2,411,017

Problems of children	799	18, 316, 080	1	23, 195	2	14, 760			12	547, 964	19	167, 720	107	2, 201, 343	940	21, 271, 062
Problems of sex	36	536, 005			1	7, 000			1	12, 090	9	66, 450			47	621, 545
Prosthetic devices	31	604, 046	4	62, 354	3	17, 000			1	32, 350			5	133, 257	44	849, 007
Psychology and psychiatry	1, 052	22, 575, 834	33	601, 940	183	2, 381, 131	48	994, 972	11	65, 753	186	1, 570, 949	240	5, 006, 468	1, 753	33, 197, 047
Radiation effects and usage	250	3, 745, 164	71	1, 844, 253	10	73, 687	17	643, 496	299	8, 612, 241	18	135, 942	1	217, 971	666	15, 272, 754
Rehabilitation	9	283, 154											38	734, 878	47	1, 018, 032
Respiratory system	281	3, 781, 046	22	770, 105	17	150, 696	4	79, 708	11	334, 614	4	30, 001	4	142, 220	343	5, 288, 390
Sanitary engineering	253	3, 619, 804	45	1, 112, 573	3	26, 000	1	13, 366	33	1, 143, 119	4	25, 016			339	5, 939, 878
Sensory organs	332	4, 918, 092	6	97, 209	42	456, 178	15	349, 170	10	173, 678	30	221, 077	29	475, 846	464	6, 691, 250
Studies on military personnel	2	18, 392	18	650, 442	32	691, 291	6	209, 890							58	1, 570, 015
Surgery	437	6, 397, 285	30	615, 526	15	156, 302			5	129, 482			1	45, 461	488	7, 344, 056
Toxicity and poisoning	147	2, 163, 391	19	457, 338	15	150, 175	4	90, 860	15	286, 904	1	21, 500	1	5, 231	202	3, 175, 399
Urogenital system	730	12, 858, 267	16	308, 827	5	43, 020	1	32, 184	16	231, 244	31	248, 926	2	10, 500	801	13, 732, 968
Venereal diseases	3	20, 815													3	20, 815

PSYCHOLOGICAL SCIENCES

Clinical psychology and psychiatry	461	13, 488, 308	10	195, 013	8	136, 201	1	11, 500	1	15, 067	2	29, 100	113	2, 833, 772	596	16, 708, 961
Communication	27	572, 687			10	223, 057	1	28, 000			1	25, 200	16	230, 301	55	1, 079, 245
Counseling and guidance (vocational)	6	155, 334			1	10, 794							16	344, 717	23	510, 845
Developmental psychology	171	4, 872, 198							1	8, 450	9	68, 166	47	1, 067, 428	228	6, 016, 242
Education and training	37	1, 087, 007			10	166, 354					1	7, 600	110	2, 143, 973	158	3, 404, 934
Engineering psychology (Human engineering)	11	339, 741	5	155, 371	21	289, 632	8	129, 046							45	913, 790
Evaluation and measurement in psychology	120	1, 978, 587	5	172, 886	22	35, 760	5	202, 656			9	96, 260	72	1, 662, 750	233	4, 148, 899
Instrumentation	7	52, 605	1	7, 561	1	21, 000					2	15, 500	1	1, 568	12	98, 234
Learning and retention	167	2, 039, 319	3	9, 247	19	224, 424	5	46, 900	6	11, 648	65	563, 530	9	307, 020	274	3, 202, 088
Manpower					2	45, 350							4	229, 358	6	274, 708
Motivation and instinctive behavior	71	885, 827			21	126, 689	4	28, 400			55	384, 667			151	1, 425, 583
Performance	22	275, 072	5	63, 301	18	215, 089	8	89, 800			5	41, 050	3	93, 189	61	777, 501
Personality	94	1, 626, 544	2	10, 930	4	41, 793	3	38, 500			1	13, 500	6	68, 136	110	1, 799, 403
Personal	46	1, 032, 907			30	637, 115							23	528, 528	99	2, 198, 550
Physiological psychology	225	4, 046, 515	7	127, 433	11	154, 423	16	379, 100	9	35, 826	24	259, 070			292	5, 002, 367
Problem-solving, reasoning, thinking	40	534, 893	2	31, 900	22	316, 776	4	100, 500			9	50, 933	15	330, 862	92	1, 365, 864
Rehabilitation and retraining	29	1, 174, 870											80	2, 088, 855	109	3, 263, 725
Sensory and perceptual processes	136	1, 801, 319	9	138, 568	58	536, 673	12	192, 900			53	510, 373	13	141, 912	281	3, 321, 745
Social psychology	176	3, 032, 006	1	10, 465	39	447, 518	9	328, 326	1	14, 860	19	198, 226	49	710, 214	294	4, 741, 615
Stress, psychological reaction to	56	1, 011, 266	8	184, 435	8	97, 924	4	90, 500			3	31, 700	1	7, 850	80	1, 423, 675
General problems in psychology	5	100, 792			6	76, 489					2	18, 726			13	196, 007
Mental health	717	16, 518, 293	17	337, 366	21	295, 027	10	256, 700	5	24, 878	18	194, 453	148	3, 559, 074	936	21, 185, 791

EXHIBIT 29

LETTER AND ANALYSIS IN SEPTEMBER 1960 BY BIO-SCIENCES INFORMATION EXCHANGE ON NUMBER AND TYPES OF INSTITUTIONS WHOSE BIOMEDICAL RESEARCH IS REGISTERED

SMITHSONIAN INSTITUTION, BIO-SCIENCES INFORMATION EXCHANGE,
Washington, September 1, 1960.

DEAR MR. CAHN: In response to your request of last week, I have brought together the attached information on the number and types of institutions in which work registered with the BSIE in 1960 is being carried out.

The figures are based on Government-supported research and are confined to research registered during the fiscal year 1960. Our list carries many more U.S. institutions and it is reasonable to assume that information on active research in a number of them is also in our records (i.e., institutions with Federal awards initiated in fiscal years 1959 and 1961, as well as work supported by non-Federal agencies).

The information is presented in tabular form. Please let me know if it needs further clarification.

With kindest regards,

Sincerely,

STELLA LECHE DEIGNAN, *Director.*

TABLE I.—*Number of institutions within the United States registered with the Bio-Sciences Information Exchange during fiscal year 1960* [1]

Total institutions	1,193
Teaching institutions	[2] 347
Hospitals	[3] 451
Other research institutions	[4] 155
Other institutions	[5] 240

[1] Based upon Federal Government supported research only.
[2] Of these 103 are multiple school institutions involving 302 different colleges.
[3] Exclusive of hospitals in which all research is administered through medical schools.
[4] Industrial and independent research laboratories.
[5] State and local governmental units, community service organizations, professional associations, etc.

TABLE II.—*Number of professional schools in medicine and related disciplines registered with the Bio-Sciences Information Exchange during fiscal year 1960* [1]

Total	178
Schools of medicine	[2] 85
Schools of dentistry	[3] 44
Schools of veterinary medicine	15
Schools of osteopathy	4
Schools of pharmacy	23
Schools of public health	7

[1] Based upon Federal Government supported research only.
[2] Includes all medical schools listed by the American Medical Association.
[3] Includes 44 of the 46 dental schools in the United States listed by the American Dental Trade Association.

TABLE III.—*Number and distribution of institutions within the United States registered with the Bio-Sciences Information Exchange in fiscal year 1960, arranged by States*[1]

State	Teaching institutions	Hospitals	Other research institutions	Total teaching and research institutions	Other institutions	Total
Alabama	6	4	2	12	3	15
Alaska	1			1	1	2
Arizona	2	3	1	6	2	8
Arkansas	1	4		5	3	8
California	32	44	14	90	18	108
Colorado	3	6		9	5	14
Connecticut	6	10	5	21	7	28
Delaware	1	4	1	6	3	9
District of Columbia	7	5	22	34	22	56
Florida	5	11	5	21	7	28
Georgia	5	6		11	5	16
Hawaii		1	1	2	4	6
Idaho	1	1		2	1	3
Illinois	16	22	7	45	16	61
Indiana	10	7		17	5	22
Iowa	7	3		10	3	13
Kansas	7	6	1	14	1	15
Kentucky	4	6		10	2	12
Louisiana	8	5		13	3	16
Maine	3	5	2	10	1	11
Maryland	5	16	5	26	5	31
Massachusetts	18	41	20	79	12	91
Michigan	7	13		20	5	25
Minnesota	6	10	1	17	4	21
Mississippi	3	3		6	1	7
Missouri	9	9	3	21	11	32
Montana	2	3		5		5
Nebraska	2	3		5	1	6
Nevada	1			1		1
New Hampshire	3	3	1	7		7
New Jersey	7	5	7	19	4	23
New Mexico	4	2		6	2	8
New York	34	60	25	119	36	155
North Carolina	6	8	1	15	1	16
North Dakota	2			2		2
Ohio	18	17	4	39	8	47
Oklahoma	6	2	1	9	2	11
Oregon	6	4	1	11	2	13
Pennsylvania	21	39	15	75	9	84
Rhode Island	4	4		8	1	9
South Carolina	4	2		6		6
South Dakota	2	3		5	1	6
Tennessee	8	7	1	16	3	19
Texas	17	14	4	35	8	43
Utah	3	4	1	8	2	10
Vermont	2	2		4	1	5
Virginia	8	7	1	16	2	18
Washington	8	5	1	14	3	17
West Virginia	2	4	1	7	2	9
Wisconsin	3	7	1	11	2	13
Wyoming	1	1		2		2
Total	347	451	155	953	240	1,193

[1] Based upon Federal Government supported research only.

BACKGROUND INFORMATION ON THE EXCHANGE

Senator HUMPHREY. Many of our inquiries to the exchange were necessarily of a preliminary nature; they were designed to establish for the record BSIE's origin, purpose, the types of its services, and certain other background facts.

There follow pertinent exhibits from BSIE in the form of my initial letter of inquiry, in addition to BSIE's response to that and to subsequent background inquiries.

EXHIBIT 30

LETTER OF FEBRUARY 18, 1960, INVITING BACKGROUND INFORMATION FROM BIO-SCIENCES INFORMATION EXCHANGE ON NATURE OF ITS WORK, EXTENT OF COVERAGE, AND RELATED MATTERS

FEBRUARY 18, 1960.

Dr. CHARLES W. SHILLING,
Chairman, Governing Board, Bio-Sciences Information Exchange,
Care of U.S. Atomic Energy Commission, Germantown, Md.

DEAR DR. SHILLING: I should like to thank you and Dr. Deignan for the cooperation which you have extended in the review of the work of the Bio-Sciences Information Exchange.

As you know, this review has been conducted in two respects:

(*a*) By the Committee on Government Operations, through its staff director, Mr. Walter Reynolds, in connection with overall problems of Federal scientific organization and documentation.

(*b*) By this subcommittee, through its project director, Mr. Julius N. Cahn, in connection with the more specialized study of medical research.

As a part of (*b*), this subcommittee is now in the process of developing, under the international health study, an interim report which we expect to go to press within a few weeks.

My personal view, at present, is that in this report the subcommittee should commend BSIE as a very valuable instrumentality for cooperation in medical research. The supporting Federal agencies and the Exchange's staff should, I feel, likewise be commended for their development of BSIE.

At the same time, I feel that the subcommittee should point out that the Exchange has not attained the full measure of its potential value. This is in part due to what I regard as avoidable gaps in its coverage.

By such gaps, I refer to—

(*a*) Nonreporting by certain Federal agencies, such as the Department of Agriculture, the National Aeronautics and Space Administration, and others;

(*b*) The fact that, apparently several of the supporting agencies themselves do not convey reports either completely or promptly or at all from all of their component bureaus or divisions, and/or on all of their intramural and extramural programs, including oversea projects;

(*c*) The fact that numerous private organizations with extensive programs do not report at all or to the degree that one might hope or expect.

I realize, of course, the various complexites so far as remedying the gaps referred to in (*a*), (*b*), or (*c*).

At the same time, I should like to extend a cordial invitation to you, to Dr. Deignan, and to your colleagues of the Board to transmit to the subcommittee a report as to (*a*) the Governing Board's views on this problem of gaps and (*b*) information on the status of efforts to remedy the gaps.

Further, I would appreciate the Board's views as to these additional points:

(1) Closer integration between supporting agencies' internal reporting systems and the BSIE file system, e.g., as regards indexing, forms, etc.;

(2) The expected ways in which the Exchange's value may be strengthened once it has completed its transition to an electronic computer basis;

(3) Problems of coverage of research projects supported by foreign i.e., non-American, official or private sources;

(4) Views in general as to the future of the Exchange.

It would be my plan to reprint this inquiry and the Board's reply—in whole or in part—within our interim report.

Thereby, I hope that our subcommittee will be in a better position to offer judgment which may be applicable as well in connection with a comparable clearinghouse for the physical sciences.

With best wishes, I am,

Sincerely,

HUBERT H. HUMPHREY, *Subcommittee Chairman.*

EXHIBIT 31

EXCERPTS OF LETTERS OF FEBRUARY 26, 1960, AND MARCH 24, 1960, FROM BIO-SCIENCES INFORMATION EXCHANGE ON NATURE OF ITS WORK, EXTENT OF ITS COVERAGE, AND RELATED MATTERS

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., February 26, 1960.

DEAR SENATOR HUMPHREY: We are pleased that you and your committee have shown an interest in the operation of the Bio-Sciences Information Exchange. The questions which you ask in your letter of February 18, 1960, are good ones and will enable us to bring you up to date on more recent happenings in the development of the program of the Exchange.

I am sure you realize that the Exchange was designed only to furnish information to the supporting Federal agencies concerning the research for which support was being requested by university or "offsite" contractors. This mission the Exchange has accomplished to the complete satisfaction of everyone.

The additional byproducts which have developed are admittedly not perfect As we see it, it is to these additional elements that your letter is largely addressed.

Since several items in the letter will take some time to answer, I am writing this interim letter to assure you that we will be most happy to give you full and complete information—for we too are proud of the accomplishments of the Bio-Sciences Information Exchange.

Sincerely yours,

C. W. SHILLING, M.D.,
Deputy Director, Division of Biology and Medicine.

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., March 24, 1960.

DEAR SENATOR HUMPHREY: As Chairman of the Governing Board, I sent you a preliminary reply on February 26, 1960, in response to your letter of February 18, 1960, concerning the Bio-Sciences Information Exchange.

It is a pleasure now to transmit a completed document cleared by the members of the Governing Board. If there are further questions we would be happy to meet with members of your staff to discuss them.

Most sincerely,

C. W. SHILLING, M.D.,
Deputy Director, Division of Biology and Medicine.

REPORT ON THE BIO-SCIENCES INFORMATION EXCHANGE

(Prepared for Senator Humphrey, Mar. 22, 1960)

This report is prepared in response to your encouraging letter of February 18, 1960, calling attention to the gaps in the information registered with the Bio-Sciences Information Exchange and asking for the plans of the Governing Board for the development of the Exchange as a documentation center for current medical research.

Before discussing the specific questions which you raise, it will be helpful to review the purpose of BSIE (and its predecessor, the MSIE) which prompted its establishment and has warranted its continued support for the past 10 years. The current interest in scientific communication has served to highlight one aspect of the Exchange, although it is seldom understood that this phase of activity is not the primary objective. It was not the intention of the founding, and now supporting, agencies to establish a complete documentation center for current medical research. The interest which the clearinghouse aspect of the Exchange has aroused is most gratifying for it is a fortunate byproduct of the

major function, i.e., the accumulation and organization of information on grants and contracts awarded by the supporting agencies in order to assist these agencies to avoid unknowing duplication of support. This interagency activity was formed as the result of two related recommendations:

(*a*) The Steelman report ("The Nation's Medical Research," vol. 5 of Science and Public Policy, Oct. 18, 1947, p. 37).

(*b*) Panel report, Subcommittee on Scientific Information, Interdepartmental Committee on Scientific Research and Development, April 1950.

As stated in the panel report:

"It was agreed that the information to be exchanged should be of an administrative and budgetary type such as is now presently voluntarily exchanged. This includes information on the type and extent of all applications for support of research and similar information on projects actually being supported. It does not include progress reports, individual project evaluations, or evaluation of programs of cooperating agencies."

and

"That this exchange of information shall be initiated by the six Federal agencies which have voluntarily cooperated and by such additional Federal agencies concerned with the support of medical research as may signify their desire to take part. The six present cooperating agencies are: Atomic Energy Commission, Department of the Air Force, Department of the Army, Department of the Navy, Federal Security Agency, and the Veterans' Administration. Two other agencies which may desire immediate inclusion are the Civil Aeronautics Administration and the Department of Agriculture. Other Federal agencies, foundations, research institutions, and industrial organizations or concerns wishing to participate may be invited to become contributing members at the discretion of the Board of Directors. (To be described below.)"

and

"That the Exchange of Information be governed by a Board of Directors composed of a duly appointed representative from each of the contributing members of the Exchange of Information."

Expansion of the extramural programs of Federal agencies, registration of the awards of major foundations and fund raising agencies, together with the BSIE organization and analysis of research registered, has produced what appears to be one of the largest, if not the largest, bodies of information on the content of current unpublished research in the life sciences. In recognition of the value of scientific communication among investigators as well as among granting agencies, the voluntary registration of intramural research and of the research by individual scientists is encouraged, and the information is made available without charge to the scientific community as a whole.

With the foregoing description as background, the several points in your letter can now be discussed:

1. Nonreporting by certain Federal agencies, such as the Department of Agriculture, the National Aeronautics and Space Administration, and others

Cooperation in the BSIE is purely voluntary. Both the Department of Agriculture and NASA are invited to become supporting agencies.

Some progress in relationships with the Department of Agriculture has been made, as evidenced by Dr. Liverman's report of February 16, 1960, to the Governing Board (attachment I).

NASA has not as yet signified an interest in joining the BSIE. The Board took formal action to invite NASA's cooperation on January 19, 1959. In the following July the Armed Forces-NRC Committee on Bio-Astronautics recommended that NASA take part in the BSIE and offered its services to enlist further support for the Exchange. The correspondence is attached (attachment II—not included in hearing volume).

2. The fact that, apparently, several of the supporting agencies themselves do not convey reports either completely or promptly or at all from all of their component bureaus or divisions, and/or on all of their intramural and extramural programs, including oversea projects

The grants and contracts of all the supporting agencies are registered with the BSIE and are up to date except in a few cases where the awards are not administered from a central office. The difficulty of maintaining liaison with decentralized groups, especially when the personnel in such decentralized units frequently changes, is obvious. This statement needs qualification in that supporting or cooperating agency is defined as that portion of the overall agency which has joined and cooperates in the Exchange. For example, in the Department of the Army the cooperating group is the Medical Research and Development Command, Office of the Surgeon General. It is not the responsibility of the Board to search for other groups within the Department of the Army with programs which fit the Exchange. However, it is the responsibility of the individual Board members to make a concerted effort to insure full cooperation from all segments of the agencies they represent. The Board will welcome any such groups which wish to cooperate.

The voluntary registration of intramural research has long been endorsed and the program is progressing satisfactorily. Registration of intramural work in the Office of Naval Research, Air Force, and the Veterans' Administration is established procedure; the Atomic Energy Commission and the U.S. Army Medical Research and Development Command have agreed to register inservice programs and the procedures are now in the process of development.

3. The fact that numerous private organizations with extensive programs do not report at all or to the degree that one might hope or expect

To our knowledge, all major national fund-raising agencies and private foundations supporting investigative research in the life sciences on a project basis are registering their awards with the Exchange. If there are "numerous private organizations with extensive programs" for the extramural support of research in the life sciences, such organizations are unknown to us.[5] The Director has met with foundation groups and interpreted the program of the Exchange, inviting cooperation without cost in all instances where the programs of the granting agencies fit the scope of the BSIE. A list of nongovernmental agencies cooperating with the Exchange is attached (attachment III—not included in hearing volume). Some noncooperating agencies, such as the Ford Foundation, are not supporting projects which fit into the BSIE pattern and are, therefore, not cooperating, although contacts with such agencies have been established.

No effort is made to completely cover the thousands of purely local foundations. The following quotation from an article by the Director and Executive Officer, in Science (May 14, 1954, vol. 119, No. 3098, pp. 661 and 662), states the reasons for the exclusion of purely local foundations.

"The diversity of such organizations and the lack of established granting policies with regard to type of research supported or the probable duration of interest in any research field have reasoned against the inclusion of these data. Most local foundations appear to be mechanisms for family or individual giving with primary interest in community services and welfare. Additional local support of research reaches universities in the form of special contributions or bequests, and no effective procedure for obtaining current information on funds of this character can be established."

One area not encompassed by the Exchange is research supported or carried on by industry. The pharmaceutical houses have felt from the beginning that participation in the Exchange might be detrimental to their competitive interests and have in the main declined participation.

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[5] SUBCOMMITTEE NOTE: The subcommittee has compiled a listing of several private organizations which do not register projects with BSIE.

4. Closer integration between supporting agencies' internal reporting systems and the BSIE file system, e.g., as regards indexing, forms, etc.

The substantive content of research is registered with the BSIE on a standard Notice of Research Project form which has been found satisfactory for both input and dissemination of information.

A comparable standard form for granting agencies to report administrative data—particularly changes such as extensions of dates, terminations of projects, changes in investigators—is greatly needed. The lack of consistent administrative reporting places great burdens on the staff of the Exchange and is an area which needs study and consideration.

The matter of indexing, and the possible development of a uniform system, is extremely complex. Prior to the establishment of the MSIE, efforts were made to develop a system satisfying the needs of all agencies cooperating in the exchange of information. After meetings, consultation, and study, the prototype of the BSIE system was developed and copies were sent to members of all cooperating agencies soliciting further advice and suggestions (see attached memorandum—attachment IV).[6]

In 1954 a special study committee of the Board suggested the establishment of a list of subject and/or administrative topics acceptable to all supporting agencies to serve as a basis for periodic reporting. Repeated efforts to bring about agreement in the development of such topics were unsuccessful. Consequently, at its meeting on December 21, 1955, the Board agreed that such a list was undesirable and that the BSIE index system could be amended as often as necessary to include the changing and added interests of the supporting agencies.

As late as 1957 the Grants Branch Chiefs of the National Institutes of Health attempted to establish a system of categories applicable to all institutes of the NIH. Repeated meetings (some attended by the Director of the BSIE), failed to produce any agreement in this single agency for a uniform system.

The probability of establishing a universally acceptable system does not appear hopeful at present. It seems obvious that all agencies desire their individual systems to meet their special needs. The function of the BSIE index is to relate the subject matter in many varied programs. Nevertheless BSIE interest in approaching a universal system continues, but until a practical solution is evolved, the wisdom of continuing various internal systems cannot be denied.

5. This will be discussed with point 7

* * * * * * *

NOTE.—Comments deleted from the letter appear in exhibit 38 since they relate to international problems referred to in detail later on in this volume.

6. The expected ways in which the Exchange's value may be strengthened once it has completed its transition to an electric computer basis, and

7. Views in general as to the future of the Exchange

It would be unwise at this time to outline fixed plans for the future of the BSIE. The current conversations on broadening the Exchange to include other disciplines, the impending action by the Department of Agriculture, and the possible inclusion of NASA as a supporting agency all affect the future development of the service in terms of its operation and its support. The Board wishes to preserve the present ability of the Exchange to provide information on a given problem, man, or institution accurately and promptly, and hopes to continue this service as the Exchange expands.

The present computer capability of the Exchange is limited to records on the numbers, amounts, and durations of awards to men, institutions, and subject areas. As requirements develop, computer capabilities will be reappraised and accordingly adjusted to meet the broader responsibilities placed upon the operation.

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[6] The attachments have not been reprinted within this hearing volume.

EXHIBIT 32

MEMORANDUM OF APRIL 19, 1960, DESCRIBING THE INDEXING SYSTEM OF THE BIO-SCIENCES INFORMATION EXCHANGE

The indexing system of the Bio-Sciences Information Exchange is expecially designed to meet the needs of its supporting agencies, which disburse funds for extramural research in the whole spectrum of the life sciences. In making awards these agencies must have current information on amounts of support available for broad areas as well as for specific types of research. The function of the Exchange is to relate projects in many different ways and to interpret subject categories in terms of source, amount and duration of support, type of recipient institution, department, etc., all of which require an accurate accounting of funds. Such an operation is wholly distinct from a library or documentation center concerned only with the storage and retrieval of information by title or subject. The clearinghouse activities of the Exchange are a fortunate byproduct of its primary responsibilities, but are nevertheless made available without charge to the scientific public.

The system is no more than a series of different and unrelated indexes, each bringing together all studies dealing with a given main topic, such as studies related to a body system, to a disease group, or to a type of research. New indexes are added when research in new areas or when new concepts of related research are developed. Entering additional indexes does not change or disturb the previous entries in the system.

Each index is divided into subcategories, sometimes of the third and fourth order. There is no common pattern of subdivision within the indexes; the subcategories are developed logically in accordance with the studies involved. In the indexes on the body systems, for example, diseases and conditions of each body system are among the subcategories. The name of a disease is entered only when information on work involving it has been received; thus, searching for studies on diseases and conditions not registered with the Exchange is eliminated. Other indexes, such as Metabolism, Children, or Tissues, provide for a wide variety of additional entries from points of view other than that of the identity of a disease.

A given study or project description must be entered into all indexes to which it applies. Within each index, however, the subcategories are mutually exclusive for purposes of accounting, but overlap freely, through cross-referencing, for retrieval by subject alone. Individual indexes are routinely reviewed and revised to reflect the changing picture of research endeavor, as well as variation in the interests of granting agencies.

The system presently contains 211 different indexes and groupings, with a total of 6,939 subcategories. The retrieval potential is almost infinite due to the numerous possible combinations and permutations of subcategories. Experience and commonsense govern the depth of refinement of the subcategories which are entered into the system.

The actual indexing of the studies registered with the Exchange is done by a professional staff holding doctorates and masters' degrees in the various fields encompassed by the Exchange. The same staff, fully acquainted with the system, selects and forwards directly to the requester all information on specific research problems. Requests for large collections and those requiring statistical arrangements are prepared by electronic data processing. The specific subject requests which the professional staff answers provide a unique service which saves the requester the chore of weeding out the many unrelated studies which are inevitable in mechanical selection or selection by personnel lacking academic knowledge of the subject. We believe the speed with which subject requests are now answered is due to the pregrouping of related research and the scientific knowledge of the professional staff.

The indexes are not designed for general distribution. An individual could not use them as lists for checking interesting or possibly applicable terms or

61916—60——9

titles to be searched in connection with a request. In our opinion a far better service is furnished when selection is done by a staff which builds and uses the indexes daily. Under the BSIE system, a requester need only define his problem or problems and he will promptly receive information on all directly related research in the total body of information.

The attached list carries the names of the major indexes and groupings currently in use, and indicates the number of subcategories in each. The variety of indexes and groupings amply demonstrates the fact that all indexes are independent and that the system is capable of unlimited expansion, regardless of discipline.

BIO-SCIENCES INFORMATION EXCHANGE

INDEXES

A. MAJOR SUBJECT INDEXES, BIOLOGICAL, MEDICAL AND SPECIAL

Title	*Number of subcategories*
Accident	9
Aging	24
Agriculture	16
Allergy	24
Anesthesia and analgesia	1
Animal reservoirs and vectors	16
Anthropology	3
Aviation medicine	1
Banks	8
Basic biology	68
Biophysics and biophysical chemistry	18
Blood	49
Body temperature	8
Cancer	80
Cardiovascular system	66
Central nervous system	15
Children	68
Connective tissue	2
Conservation and wildlife management	1
Deficiency diseases and nutrition	47
Dental diseases and conditions	17
Digestive system	64
Ecology	1
Endocrine system	75
Environment	19
Environmental sanitation	7
Epidemiology	14
Experimental embryology	1
Followup	43
Heredity and genetics	45
Hospital and medical facilities and administration	1
Immunity	36
Infectious diseases	138
Injury and shock	10
Instrumentation	265
Intoxication and drug addiction	3
Isotopes	94
Lymphatic system	10
Metabolism and metabolic diseases	58
Military personnel studies	8
Morbidity and mortality	1
Musculoskeletal system	50
Nervous system	65
Nonresearch projects	38
Nursing	1
Occupational diseases	15
Oceanography	1
Organisms	692
Prosthetic devices	6
Public health	1
Radiations	15
Radiation effects	39
Rehabilitation	1
Respiratory system	57
Sensory organs and systems	52
Sex	1
Skin	39
Space medicine	9
Special defense activities	11
Specialized treatments	30
Stress	12
Submarine medicine	1
Substances	2,623
Surgery	44
Techniques, biomedical	280
Techniques, psychological	271
Test animals	211
Tests and methods	50
Tissues	101
Toxicity and poisoning	139
Urogenital system	32
Venereal diseases	6
Viscera, body cavities, etc	8
Indexes	73
Subcategories	6,335

B. MAJOR SUBJECT INDEXES, PSYCHOLOGICAL

Title	Number of subcategories
Clinical psychology and psychiatry	53
Cognitive processes	8
Communication	7
Counseling and guidance (vocational)	7
Developmental psychology	36
Education and training	27
Engineering psychology (human engineering)	14
Etiology of mental diseases and conditions	28
Evaluation and measurement in psychology	12
Learning and retention	11
Manpower	4
Motivation and "instinctive" behaviors	46
Performance	7
Personality	27
Personnel	14
Physiological psychology	55
Psychophysiological methods	14
Rehabilitation and retraining	3
Sensory and perceptual processes	25
Social psychology	14
Therapy of mental diseases and conditions	59
General problems in psychology	1
Stress, psychological reactions to	1
Instrumentation	1
Indexes	24
Subcategories	474

C. INDEXES OF MISCELLANEOUS SPECIFIC TOPICS

Title	Number of subcategories
Acidosis and alkalosis	1
Adipose tissue	1
Alertness	1
Amyloidosis	1
Animal sounds	1
Anoxia and hypoxia	1
Arctic and Antarctic studies	1
Artificial insemination	1
Aschoff bodies	1
Biological rhythms	1
Biostatistics	1
Bites	1
Blood volume	1
Calcification	1
Caves and cave life	1
Cell wall	1
Chronic and degenerative diseases	1
Chronic toxicity	1
Ciliary activity	1
Climatology and meteorology	1
Coma	1
Community services	1
Convalescence	1
Crime	1
Culture collections	1
Delusion	1
Disaster	1
Drowning	1
Drug action and metabolism	1
Economics	1
Electromyography	1
Engineering, military	1
Engineering, other	1
Evolution	1
Exercise	1
Extracorporeal devices	1
Fatigue	1
Feedback	1
Filtrate disease,	1
Fluid balance, total, including electrolyte balance	1
Foreign substances in tissues	1
Fractionation	2
Geology	1
Germ-free life	1
Gradients	1
Handedness	1
Heart and vessel sounds	1
Homeostasis	1
Hospital-acquired infections	1
Human ecology	1
Humor	1
Hydrobiology	1
Hypnosis	1
Indicator plants and micro-organisms	1
Inflammation	1
Interference phenomenon	1
Isolation, perceptual and social	1
Jaundice	1
Language and linguistics	1
Malformations	2
Mast cells	2
Mathematics and biomathematics	1

C. INDEXES OF MISCELLANEOUS SPECIFIC TOPICS—continued

Title	Number of subcategories
Medical costs	1
Medical education	1
Medicinal plants and animals	1
Medicolegal	1
Micromanipulation	1
Meiosis and fertilization	1
Nausea and vomiting	1
Negro problems	1
Neuromuscular junction	1
Nitrogen balance, total	1
Organic synthesis	1
Pain	2
Paleontology	1
Parabiosis	1
Parthenogenesis	1
Patient care	1
Performance, physical	1
Photic stimulation	1
Photoperiodism	1
Photoreactivation	1
Physical fitness	1
Pineal body	1
Plasma cells	1
Population	1
Porto-caval shunt	1
Prisoners of war	1
Posture	1
Psychopharmacology	11
Pulmonary ventilation	1
Radiation hazards and accidents	1
Reaction time	1
Reiter's syndrome	1
Religion, mental health aspects	1
Rescue operations	3
Serotype reference centers	1
Sleep and hibernation	1
Smooth muscle	1
Social science	1
Socioeconomic status	1
Speech	1
Subception, subliminal perception, subliminal stimulation	1
Suicide	1
Symbiosis	1
Syncope	1
Tachyphylaxis	1
Thirst	1
Thymus	1
Tropical medicine	1
Twin studies	1
Viscosity	1
Vocation choice	1
Nonspecific	1
Indexes	114
Subcategories	130
Total indexes	211
Total subcategories	6,939

APRIL 1960.

EXHIBIT 33

EXCERPTS OF LETTER OF JUNE 9, 1960, FROM BIO-SCIENCES INFORMATION EXCHANGE DESCRIBING ITS ANALYSES AND TERMINOLOGY

* * * * * * *

5. ANALYSES OF SUPPORT OF DEPARTMENTS IN INSTITUTIONS

Provision of this type information is not a routine procedure; the information is provided in response to each request. Attachment 5–1a is an example of the summation of support to an individual department in an individual institution. The summary sheets were backed by the pertinent notices of research projects which illustrate the types of projects and their total support. Attachment 5–1b is a copy of a covering letter transmitting IBM listings covering a number of individual departments. Requests of this magnitude have been declined during our conversion period.

6. DEFINITION OF TERMS

(*a*) *Subject request.*—Attachment 6a–1 is typical of a simple subject request. The request came in the form of a letter. A BSIE professional associate listed the notices which were to accompany her reply. A clerk selected the notices from our library and removed the information on the funds. The notices were attached to the letter of reply. The list of projects is kept so that additional information may be selected for future requests from the same individual. The requester received considerably more than a brief title. The request reached the BSIE June 6; the information was forwarded on June 9.

Attachment 6a–2 is typical of a more extensive subject request. This request came by telephone on May 4 and was answered on May 13.

(*b*) *Report on the support of applicants.*—These reports consist of summary sheets on the total support of all investigators concerned with a given application. The summary sheets are accompanied by a notice of research project on each application or project mentioned. Attachment 6b–1 illustrates a report on an investigator with little other support; attachment 6b–2 illustrates an extensively supported investigator. No record is usually kept of these individual reports as the information is out of date the day after it is prepared.

EDITORIAL IN MAGAZINE, SCIENCE

Senator HUMPHREY. The renowned magazine Science, published by the American Association for the Advancement of Science, carried an editorial on BSIE as follows:

EXHIBIT 34

EDITORIAL IN SCIENCE, AUGUST 8, 1958, ON UTILITY OF BIO-SCIENCES INFORMATION EXCHANGE

WHO? WHAT? WHERE?

If those agencies—either public or private—that make grants and contracts for research are to allocate their grants wisely and without duplication, they need to know about each other's activities. They need to know who is getting grants for what projects and where the work is being done.

Recognition of the need for this kind of information by the Government agencies granting aid for medical research led to the setting up of several information exchanges following the dissolution of the Office of Scientific Research and Development in 1946. The largest of these was the Office of Exchange of Information in the Public Health Service. As the number of grants and the amounts granted by Government and cooperating non-Government agencies increased (from $4.3 million in 1946 to $33 million in 1949) the separate exchanges were consolidated, and the service was shifted to the National Research Council to simplify interagency support and was given a name that more clearly expressed its function, the Medical Sciences Information Exchange.

By 1953, the Exchange was assembling information about awards that totaled $56 million and had expanded into the fields of biology and psychology. For administrative reasons, the service was shifted again, this time to the Smithsonian Institution, and its name was changed to the Bio-Sciences Information Exchange to reflect its larger scope. The expansion of the Exchange has continued: It now has registered with it some 17,000 active research projects; new grants for fiscal 1958 totaled 11,897, of which 9,706 were made by Government agencies and 2,191 by non-Government agencies; the grants totaled $164 million, of which $134 million was granted by Government and $30 million by non-Government agencies.

The information offered by the exchange is obtained from an elaborate index—there are more than 6,000 subject categories—based upon the reports of research projects prepared by investigators who apply for grants either to Government or the major non-Government agencies. The data so supplied are transferred to punch cards, and the information can be rapidly assembled according to whatever criteria are selected. Cooperating agencies, committees, and properly qualified individuals can obtain information from the exchange at no cost. Thus, before it expanded its activities into support of research in rheumatoid arthritis and congenital malformations, the National Foundation for Infantile Paralysis could have obtained information about the total money currently granted for research in these fields.

Not the least interesting of the Exchange's services is that available to the individual investigator. Every scientist has heard at least one sad tale about one of his fellows who was just about to ship off a manuscript only to discover that someone else had done his work for him. This is more than a source of distress for the individual scientist: it is a wasteful duplication of effort. A scientist interested in a particular subject may, even though he has no grant, register his project with the Exchange. (About 3,000 have done so this year.)

He may also ask the Exchange to give him the names and project descriptions of others working in the same specific field. The first step may lead others—granting agencies or individuals—to get in touch with him; the second gives him a chance to find out what others in his field are interested in and thus reduces his chances of duplicating work being done elsewhere.

The Exchange invites cooperation. Inquiries should be addressed to Dr. Stella Leche Deignan, Director, Bio-Sciences Information Exchange, Room 1113, Dupont Circle Building, 1346 Connecticut Avenue NW., Washington 6, D.C.—G.DuS.

DIFFERENCES IN NATURE AND EXTENT OF AGENCY REPORTING TO BSIE

Senator HUMPHREY. One of the facts which our subcommittee noted quite early in its review is that the various agencies reporting to the Exchange differ in their practices very considerably.

Not only do they differ as to what they report, but they differ as to when they report it, and how they report it.

In response to our inquiries, BSIE supplied the following information:

EXHIBIT 35

EXCERPTS OF LETTER OF JUNE 9, 1960, FROM BIO-SCIENCES INFORMATION EXCHANGE ON AGENCY FORMS, EXTENT OF REPORTING

SMITHSONIAN INSTITUTION,
BIO-SCIENCES INFORMATION EXCHANGE,
June 9, 1960.

DEAR MR. CAHN: * * * I have brought together the additional information you requested.

* * * * * * *

2. Agency practice as regards information of applicants' proposals.

(*a*) *NIH.*—The notice of research project is a part of the application form. Forwards the notice with a copy of each application as it is received.

(*b*) *Army.*—Not registering applications at present. As applications are approved the agency sends BSIE a copy of the OTSG form 613 (attachment 2b)[7] and also sends a notice form to the investigator for completion with request that he forward completed form to BSIE. If contracts are continued, the Exchange asks the investigator to review summaries annually. It should be noted that this is the current picture. This agency is in the process of revising its procedures and will be registering proposals shortly.

(*c*) *Navy.*—Provides monthly lists of proposals. Provides copies of approved contracts monthly. BSIE requests summaries on approved contracts (attachment 2c).[7]

(*d*) *Air Force.*—OSR provides monthly lists of proposals. Sends copies of approved contracts monthly. At present no summaries are received; procedures are in process to revise reporting to the Exchange. SAM does not provide proposals. Sends form DD 613 on each approved contract as contract is approved (attachment 2d).[7] BSIE requests summaries.

(*e*) *AEC.*—Provides lists of proposals and of awards monthly. The agency requires investigators to provide summaries while approved contracts are in process of negotiation.

(*f*) *NSE.*—Provides lists of proposals three times a year. Lists of awards are provided quarterly. BSIE requests summaries on all awards.

(*g*) *VA.*—Is an inservice operation. All inservice projects are registered and reviewed annually.

* * * * * * *

During our telephone discussion you mentioned that you would like a breakdown of the Government intramural and extramural projects among the ap-

[7] The attachment is omitted herein.

proximately 30,000 active projects registered with the Exchange. The breakdown is as follows:

	Extramural	Intramural	Total
NIH	9,976		9,976
Other HEW	144		144
Army	487	10	497
Navy	660	65	725
Air Force	80	79	159
AEC	353		353
NSF	2,115		2,115
VA		10,403	10,403
Total	13,815	10,557	24,372

These figures are based on a given point in time, they may include more than the awards in 1 fiscal year; they may lack grants terminated shortly before for which additional awards have not come through. Thus these numbers undergo constant change.

Sincerely,

STELLA LECHE DEIGNAN, *Director.*

USAGE OF BIO-SCIENCES INFORMATION EXCHANGE

Senator HUMPHREY. A committee such as ours which is concerned with Federal economy and efficiency is naturally interested in determining just how much an interagency instrumentality like the Exchange is used and with what results.

Determining usage and results is a complex matter and must be carried out with extreme care in fairness to all concerned. Statistics alone can hardly tell the story. A single use may save an immense amount of scientific effort, whereas a report reflecting a relatively high statistic of usage may not turn out to be really meaningful.

On this matter of usage, on several occasions BSIE has supplied certain information at our request. This information is of two types: (*a*) Excerpts of responses from users and (*b*) statistics as to various categories of users and their respective usages. (Earlier within this transcript, we have drawn upon some of the latter statistics.)

It will be noted, as regards (a), the excerpts from correspondence containing reactions to the Exchange, that the messages come from both American and foreign scientists and from basic and clinical researchers. As to Americans' reactions, they were conveyed by both Federal and non-Federal researchers.

The subcommittee has not attempted and could not attempt within the limited time available a scientific sampling of BSIE correspondence files as regards reactions. It presents these particular excerpts merely as illustrations of some of the messages received by the Exchange.

Both of these types of information follow:

EXHIBIT 36

EXCERPTS OF SOME OF THE REACTIONS RECEIVED BY THE BIO-SCIENCES INFORMATION EXCHANGE FROM USERS

Azusa, Calif.

We received notices of research projects concerning closed ecological systems and infrared medical instrumentation 9 days after our visit. In addition to this remarkably fast service, these notices have already prevented duplication of work since one described a project which we were planning to initiate.

Glen Oaks, Long Island, N.Y.

Thank you very much for the references describing thyroid function tests. We have noted some studies of interest to us, and shall make an effort to expand our information through direct contact, prior to undertaking our projected studies.

New York City, N.Y.

We deeply appreciate your letter of February 1 and the summaries describing the current studies of leukemias and lymphomas which have been registered with the Bio-Sciences Information Exchange.

This information will be most helpful to the recently formed____Committee to study the present status of research in these areas.

Your service is simply fabulous, as I find waiting for me the reports which you promised me. I shall read them with a great deal of interest and I know that they will help me in my explorations.

Philadelphia, Pa.

Thank you for sending the copies of the Notice of Research Projects. They have arrived safely.

I understand that these summaries are not to be used for publication or publication reference without the permission of the principal investigator involved.

These materials will be of great use to the Committee which will meet in Geneva this March.

Baltimore, Md.

Thank you very much for the information on the Bio-Sciences Information Exchange which I requested. We are exploring the possibility of setting up some type of information exchange in reference to the work the different groups involved in psychiatric research are doing locally so we may know who to consult in order to discuss our mutual problems. How far this will develop, I do not know. At most, it may only amount to an experiment in attempting to improve our local communications.

New York, N.Y.

Thank you very much for your letter of February 17, 1960, and for the list of agencies supporting research in the biosciences. This is exactly the information I was seeking.

Tokyo, Japan

I received your letter of April 7, 1960, and for the Notices of Research Projects describing current investigations dealing with the biological nitrogen fixation with much gratitude.

It is my greatest pleasure that these notices will be helpful in putting me in touch with other workers in my field of interest.

Langhorne, Pa.

Your program is making an outstanding contribution to the communication of research activities throughout the Nation, and in so doing I feel it is an indispensable service.

Port Elizabeth, Union of South Africa

Thank you for sending me notices of research projects related to the study of multiple sclerosis. I find these notices most valuable, and I would appreciate it if you would send me further notices in due course.

Buenos Aires, Argentina

I would like to receive information about studies currently under way on the subjects: (a) Acute and chronic experimental renal hypertension, and (b) role of the angiotensin (hypertensin or angiotonin)-renin system in experimental and human hypertension.

This information will be of great value to me and my colleagues since we are working in this area of research.

Mexico, D.F.

I would like to take advantage of your system and ask you to be so kind of making available to us any information on research work being done elsewhere that you might know about and related to our field of interest, enzyme activity in the regenerating liver.

Lewisburg, Pa.

Thank you very much for the group of summaries of research projects which you sent in response to my letter of December 10. There are several of these which I was not aware and knowing about them will be quite helpful to me.

Ann Arbor, Mich.

Thank you for sending me the selected notices of the Bio-Sciences Information Exchange. One or two of the projects seem to offer possibilities of considerable valuable exchange of ideas about common research problems.

Minneapolis, Minn.

As a result of these notices we have become aware of projects we did not know of and will be able to contact researchers in areas of our special interests. Thank you so much for your help.

This is certainly a helpful service to those of us who contemplate studies in the same areas.

Little Rock, Ark.

Please send notices concerning:

1. Studies emphasizing methods of freezing cells and tissues and the effects of freezing and thawing.
2. Work on the use of frozen and frozen-dried tissues for transplants.
3. Physical and physiochemical aspects of ice formation in cells and theories of cell death.
4. Studies of tissue damage in frost bite.
5. Preservation of cells and tissues by freezing or freeze-drying.

Many thanks for your kind attention in this matter. Your service is of great help in favoring personal contacts between investigators.

Montreal, Canada

I would like once more to tell you how pleased I am and how helpful I find your notices in guiding to proper correspondence with the various researchers.

Hamilton, Ontario

We are engaged in planning a study of cytochemical changes and changes of mitotic index of pituitary and pancreas in experimental diabetes.

Before starting this work, it would be very helpful to know of other similar work in progress elsewhere. I should be very grateful for any information of such work you may be able to provide.

Belgian Congo, Central Africa

I have been working for some years on vitamin A deficiency in Africa.

I should be very glad if you could let me know what other projects are underway or are being planned in this field.

Curitiba, S. Brazil

I am very interested in knowing names and addresses of other investigators working on congenital amputations, experimental teratology and culture of mammal embryos. Could you help me?

Bethesda, Md.

I would like to thank you for the abstracts of studies on brain damage in young children which you prepared for us. They have been very helpful in our review of the literature and in our planning for future examinations for the collaborative study.

We would appreciate very much if you would keep us informed on any new projects concerning the psychological evaluation of CNS damage in infancy and childhood which might come to your attention in the future.

Baltimore, Md.

In 1957 you were kind enough to send me notices of research projects in ophthalmology. I found that these have been extremely helpful.

Washington, D.C.

I think you'll be interested to know that I recently received, through registration with the Exchange, an inquiry about my research project, "Communications in Noise," from * * * England. As a result of this contact, we have arranged a personal meeting this fall at Oxford.

I know that you appreciate the great scientific value of such exchanges. Nevertheless, I would like to emphasize my conviction that the Exchange should continue and expand its international coverage.

Pasadena, Calif.

The notices of research projects which we received last year were very helpful to us in our own research projects.

San Jose, Calif.

We have use for notice of research projects on the following subjects as available. Our use is chiefly for the exchange of bibilographic information and information on instrumentation and methodology.

1. Migratory studies of vertebrates.
2. Migratory studies of invertebrates.
3. Physiology of reproduction in birds.
4. Effects of altered photoperiods on vertebrates and invertebrates.
5. Studies in periodicities in animals and plants.

Your service has been very useful to us thus far and we are anxious to take further advantage of its uses.

Baudette, Minn.

It is good to know that your services are available to us. Needless to say, it is often quite difficult to locate groups conducting research in areas of interest to us. We shall no doubt call on you again, as needs arise.

Salisbury, N.C.

It was with great pleasure that I received and read the notices of research projects which you so graciously supplied. It is a privilege to pursue research at a time when such stimulating and practical aids are offered. If at any time I may be of help to your group, I shall count it a privilege.

Raleigh, N.C.

Thank you for the notices on: (1) Marine radiobiology, (2) marine genetics, and (3) related topics. It is heartening to discover that one's work is not being duplicated. Also, it is extremely useful to have thumbnail sketches of the aims of research teams with whom in many cases I have exchanged reprints.

Chicago, Ill.

This will acknowledge your letter of April 20 with which you forwarded a compilation of notices of research projects in the field of dentistry and allied sciences.

This information will be invaluable to the work of this office, and I want to thank you very much for your splendid cooperation.

EXHIBIT 37

EXCERPT FROM LETTER OF JUNE 9, 1960, FROM BIO-SCIENCES INFORMATION EXCHANGE CONTAINING STATISTICS OF SUBJECT-TYPE USAGE BY VARIOUS AGENCIES

* * * * * * *

3. USAGE BY AGENCIES

(*a*) Breakdown of subject requests from supporting agencies in accordance with my letter of May 19, 1960:

Army	16	AEC	32
Navy	24	NSF	5
Air Force	29	VA	35
DOD	10		
NIH	307	Total	520
Other PHS	62		

(*b*) Breakdown of subject requests from nonsupporting Government agencies:

FTC	1	Commerce	2
Agriculture	4	State	1
Children's Bureau	24	NATO	6
Other HEW	24	National Research Council	15
CIA	2	State and local health agencies	37
FAA	1	Miscellaneous	10
NASA	1		
DASA	1	Total	130
Labor	1		

4. USAGE AS REGARDS INDIVIDUAL APPLICANTS

(*a*) *NIH.*—Routinely receives information on all applicants.
(*b*) *SGO, Army.*—No information on applicants at present. Procedures for this are in progress.
(*c*) *Navy.*—Routinely receives information on all applicants reviewed by AIBS.
(*d*) *Air Force.*—No routine procedure. Occasionally makes requests for such information.
(*e*) *AEC.*—Routinely receives information on all applicants.
(*f*) *NSF.*—Routinely receives information on all applicants.
(*g*) *VA.*—Not pertinent.

International Exchange of Information on Current Research

Senator Humphrey. It will be recalled that the subcommittee has concentrated, since August 1958, on international phases of cooperation in medical research. This was in accordance with the international focus of our authorizing resolution, Senate Resolution 347, 85th Congress.

Therefore, one of the aspects which we have considered in detail is the two-way flow of information overseas on current projects.

There will follow a memorandum by myself outlining this international phase and including numerous additional exhibits.

Memorandum by Senator Hubert H. Humphrey on International Ramifications of Registration of Current Research Projects in the Life Sciences

This memorandum concerns worldwide implications of current scientific research—a matter in which I am deeply interested as a member of the Senate Committee on Foreign Relations as well as in the capacity of chairman of this particular study.

QUESTIONS ON WORLDWIDE PHASES

Since agencies of the U.S. Government are making small, but increasing grants to foreign scientists and institutions, certain questions such as the following naturally arise:

(1) To what extent are U.S.-supported research projects overseas registered with the Bio-Sciences Information Exchange?

(2) To what extent are the Federal agencies informed as to the current work of foreign scientists and institutions who are supported by sources other than the United States?

In turn:

(3) To what extent are these other financial sources familiar with current work supported by the United States and carried out on the part of our own and other scientists within our own borders?

(4) To what extent are individual foreign and American scientists and institutions informed as to the work being conducted under U.S. auspices anywhere in the world—either abroad or here at home?

Limited time does not permit us to explore even a fraction of the ramifications of this oversea phase of the problem.

Mention, however, should be made within this record of the following evidences:

BSIE RESPONSES ON FOREIGN PHASES

1. First, there appear excerpts from several BSIE replies bearing upon the international phase.

As far back as February 18, 1960, we took up this type of coverage with BSIE. There follow pertinent excerpts from an initial letter of response. (Other phases of this same letter bearing upon domestic phases are found in exhibit 31.)

EXHIBIT 38

EXCERPTS FROM LETTER OF MARCH 24, 1960, FROM BIO-SCIENCES INFORMATION EXCHANGE REGARDING NONREGISTRATION OF FOREIGN-SUPPORTED PROJECTS

* * * * * * *

6. PROBLEMS OF COVERAGE OF RESEARCH PROJECTS SUPPORTED BY FOREIGN, I.E., NON-AMERICAN OFFICIAL OR PRIVATE SOURCES

The Board has long given thought to including foreign research in the Exchange. It is the consensus that research in foreign countries supported by cooperating agencies (both supporting and nonsupporting) should be included and that the Exchange might encourage the registration of research sponsored by organizations supporting research of an international character, of which the United States is an official member.

With reference to establishing the BSIE as the authoritative information center for worldwide research in the life sciences, the Board is firmly against the plan. It is recognized that no single country (particularly the United States) could successfully carry out such a mission. We feel that a worldwide exchange of information in the medical sciences should be part of an international body such as WHO, in which representatives of cooperating countries would be responsible for the development of the activity in their individual countries. This point of view is taken because of the boundaries which exist in many countries, not only between disciplines, but even between and within institutions. There is no restriction on the voluntary registration with the BSIE of research carried out in foreign countries, and the strengthening of such individual cooperation is encouraged. BSIE information is now available to international groups and to individual foreign scientists. For example, the Exchange supplies information on an annual basis to an international panel interested in multiple sclerosis; AGARD, a part of NATO, also receives information routinely. The director attended an international meeting of physiologists in Brussels in 1956 and talked with scientists of many countries of the clearinghouse functions of the Exchange. An informal agreement to process and index information on the medical research grants of WHO has been offered.

Better international exchange of information can be accomplished with the BSIE cooperating as a U.S. member and offering special services such as indexing, rather than establishing the Exchange as the major or directional central office.

* * * * * * *

COVERAGE OF U.S.-SUPPORTED PROJECTS OVERSEAS

Coverage of U.S.-supported research projects overseas was referred to, as follows, in excerpts from an additional response.

EXHIBIT 39

EXCERPTS FROM LETTER OF MAY 16, 1960, FROM BIO-SCIENCES INFORMATION EXCHANGE ON COVERAGE OF U.S.-SUPPORTED OVERSEA PROJECTS

INTERNATIONAL COVERAGE OF FEDERAL AND NON-FEDERAL GRANTING AGENCIES

* * * * * * *

(2) The following Government agencies made foreign awards and these were registered for fiscal year 1959: Atomic Energy Commission; Office of Scientific Research, Department of the Air Force; Office of the Surgeon General, Depart-

ment of the Army; Office of Naval Research (biosciences), Department of the Navy; National Institutes of Health.

(3) The awards of all American nongovernmental granting agencies cooperating in the Exchange are registered. This BSIE selects from these awards those which involve research in the life sciences. Foreign awards from each non-Federal agency checked on the attached list (Note—Not reprinted within this volume) were registered during the fiscal year 1959.

Foreign granting agencies and foreign institutions do not register research with the BSIE.

* * * * * * *

[Continuation of Senator Humphrey's memorandum]

COMMENTS FROM FINNISH LEADER

It will be noted that, in August 4, 1959, as reported in part II, the appendix to our international health hearing, the Director General of the State Medical Board for Finland, Niilo Pesonen, M.D., had written on, among other subjects, "The Danger of Doubled Research Work." He wrote:

* * * * * * *

"Anyone versed in medical literature cannot help noticing the immense amount of doubled research work which always has been and still is performed in the field of medical and in all probability also other sciences. Of this I myself have good experience as former professor of anatomy and dean of the medical faculty at the University of Helsinki. Nevertheless, such overlapping can naturally never be entirely avoided, but on the other hand it is also clear that great economic losses are caused by the fact that scientists do not know what research work is or already has been carried out in each particular field. I myself have often experienced that when working on a certain research, a treatise on the very same or corresponding problem is published in some other part of the world which either nullifies my own work by rendering it less topical, or otherwise decreases its value considerably. For this reason and considering in addition the appreciable savings that could be achieved by avoiding doubled work and used in financing other scientific research, urgent measures should be taken to alleviate the present situation.

"As far as I can see, adequate methods to prevent overlapping in the field of medical research could be found. International register centers can be established and made responsible for the registration of all research work in the different branches of medicine. By granting means to certain international laboratories or research institutes, these could be commissioned with the task of keeping a register on all scientific work carried out in the world in their respective fields of medicine. To keep the rosters of the register centers up to date, it is naturally inevitable that different institutes, i.e., their directors, send the relevant register center once or twice a year information on all research work that is being done in the institutes concerned. The information thus collected would then be published periodically by the register center or the scientists planning some research work in the relevant field would write to the register center and ask whether the research in question already has been carried out elsewhere and if so where it could be seen.

"The establishment of only one register center comprising all medical research naturally cannot be thought of. The registration should, therefore, be divided according to the most general specialties so that a certain laboratory or research institute would agree to keep rosters for all research work carried out in the field of surgery, another in the field of internal diseases, a third one for ophthalmological research work, the fourth on gynaecological and perhaps also obstetrical research and so on.

"The idea as such is not new. A register center of scientific research in the field of embryology is known to exist in Amsterdam and as far as I know it is operating on the lines described above. The significance of such activity to international medical research cannot be overestimated. Consequently, I for my part would regard the establishment of such register centers as one of the most important practical measures that should be taken for the promotion of international medical research."

* * * * * * *

CHART ON GAPS IN COVERAGE

One of the earliest steps which I asked the staff to take was to develop a chart which would show exactly what the gaps are in registration of projects—both U.S.-supported and foreign-supported.

In referring to the absence of registration of foreign-supported projects, I do not imply that BSIE, itself, could or should want to register foreign-supported projects. But, as I will note in the record, shortly, I believe that WHO, CIOMS and other sources should address themselves to this problem of registration on an international basis. This is not a U.S. problem, as such; it is a world problem, a world opportunity, a world responsibility, a world need, as I see it.

In the meanwhile, the staff chart which was prepared months ago at my request depicts the gap problem.

Since the chart was prepared, steps have fortunately been taken to close several of the gaps, e.g., as regards the Department of Defense.

The chart follows:

EXHIBIT 40

CHART ON THE STATUS QUO OF COVERAGE OF RESEARCH PROJECTS IN THE LIFE SCIENCES BY BIO-SCIENCES INFORMATION EXCHANGE

* * * * * * *

CONTACTS WITH WORLD HEALTH ORGANIZATION

In order to ascertain the reactions of various international authorities on the subject of registration of current foreign-supported research, I addressed letters of inquiry to Dr. M. G. Candau, Director-General, World Health Organization, and to some of the members of WHO's Advisory Committee on Medical Research.

It has not been possible, within the short period of time since the transmittal of the letters, to secure substantive reactions. Among members of the WHO committee who have however already acknowledged the inquiry and indicated interest in the subject have been Prof. Arvid J. Wallgren, emeritus professor of pediatrics of the Karolinska Institute and Chairman of the Advisory Committee; and Sir Harold Himsworth, Secretary of the United Kingdom Medical Research Council.

We await with interest the further substantive reactions of committee members.

The matter has also been taken up with Dr. J. F. Delafresnaye, executive secretary, Council for International Organizations in Medical Sciences.

My letter of inquiry to Dr. Candau follows:

EXHIBIT 41

LETTER OF JUNE 2, 1960, TO WORLD HEALTH ORGANIZATION INVITING REVIEW OF PROBLEM OF REGISTRATION OF FOREIGN-SUPPORTED RESEARCH PROJECTS

DEAR DR. CANDAU: This U.S. Senate subcommittee is now in process of developing the official findings to be part of its report to the Senate.

These findings will concern: (*a*) international medical research, and (*b*) international medical assistance.

I am writing to you today to ask whether my colleagues and I might have the benefit of your informal reactions and those of your staff to one particular phase of our tentative findings on international medical research.

In inviting your further cooperation, let me mention once again that I recognize that no official commitment or position whatsoever need or might be implied by the kind sharing of your and your staff's personal observations with the subcommittee.

Submitted herewith is a draft statement which our staff has developed. It pertains to the problem of: "How can scientists of the nations communicate on their current research work more promptly and more efficiently?"

We have singled out this phase of current research projects as a high priority problem.

We distinguished two phases of the long-standing problem of scientific communication. Both are critical phases, but we regard the first as even more significant than the second. The phases are (1) communicating before a research project is undertaken, i.e., before a scientist finalizes his project proposal and/or before a granting body approves it and it gets underway; (2) communicating after research is completed (if only in part) through oral and published reports.

Ex

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BY BIO-SCIENCES INFORMATION EXCHANGE
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AND THE TYPES OF PROJECTS SUPPORTED
WHICH ARE NOT NOW COVERED BY

What 100% Coverage of All Current Research - Anyw

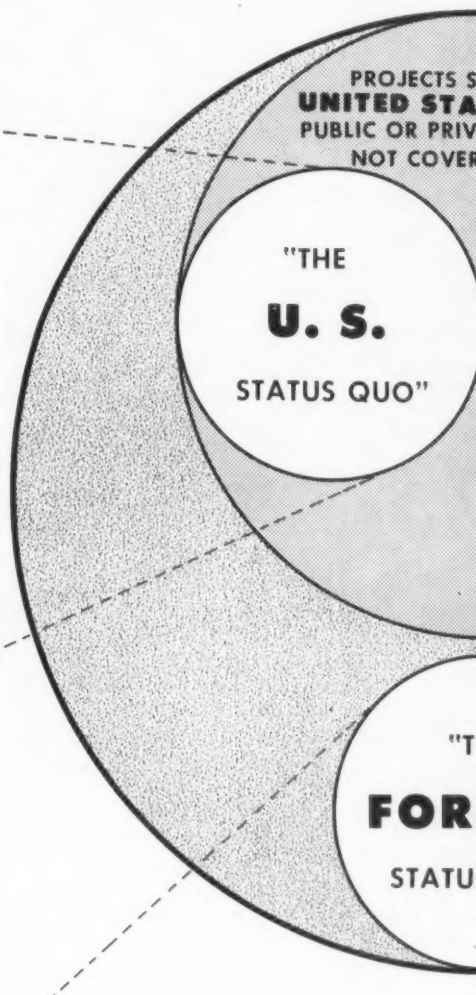
The Total of ALL American -
Including Those NOT N

The Total of **THOSE** U.S. - Supported Projects –
NOW Covered by B.S.I.E.
Federal and Non-Federal

B.S.I.E. Coverage of Federal Government-Supported Projects

- National Institutes of Health - Extra-Mural
- Atomic Energy Commission
- Veterans Administration
- National Aeronautics and Space Administration
- Department of Army - Certain Units
- Department of Navy - Certain Units
- Department of Air Force - Certain Units
- National Science Foundation

B.S.I.E. Coverage of Numerous PRIVATE Foundations, Institutes, Voluntary .lealth Agencies



The Total of **FOREIGN** - Support
Covered by B.S.I.E. or by Any U.S

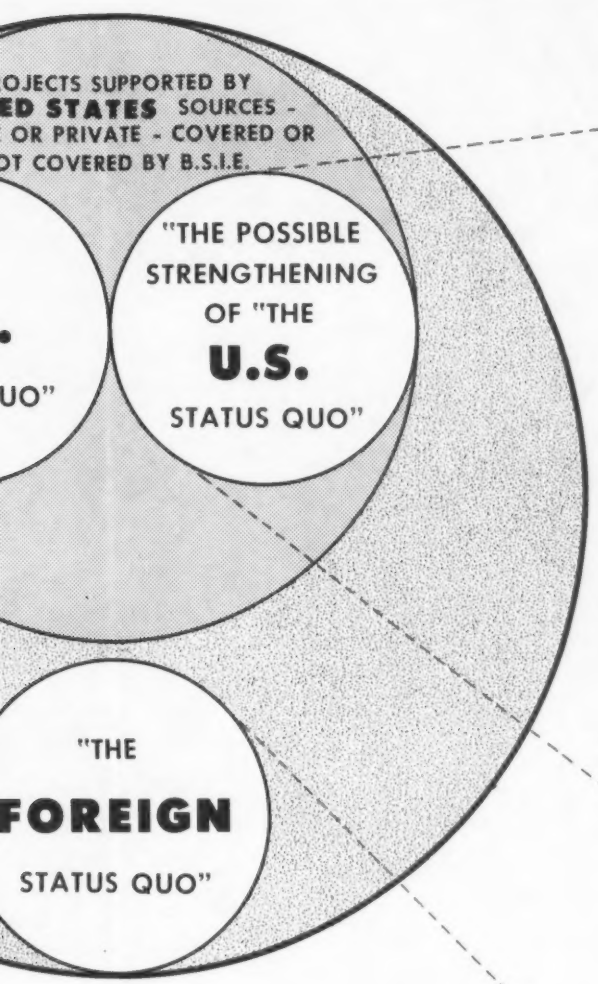
Supported by Foreign Governments	Support Inter-Govt. Or
• United Kingdom • France • Soviet Union • Sweden • Other Foreign Govts.	• W. H. O. • Other U.N. Agencie Governm anizatio

EXHIBIT 40

OF RESEARCH PROJECTS IN THE LIFE SCIENCES
ANGE (B.S.I.E.) OF THE SMITHSONIAN INSTITUTION
OF MAY 1960
RTED BY **U.S.** AND/OR **FOREIGN** SOURCES
D BY THE EXCHANGE OR BY ANYONE ELSE

Anywhere in The World - Might Entail (If it were possible)

can - And Foreign-Supported Projects
NOT Now Covered by B.S.I.E.



The Total of **ALL U.S.** - Supported Projects - **NOT** Now Covered by B.S.I.E. Which Might Possibly Be Brought Into Coverage

FEDERAL Projects **NOT** Now in B.S.I.E.'s Coverage

- National Institutes of Health Intramural
- Other Public Health Service Units
- Other HEW Departments
- Department of Agriculture
- Department of Interior - Fish & Wildlife Service
- Department of Defense - Certain Units
- Department of Army - Certain Units, Chem. Corps, QM Corps, Etc.
- Department of Navy - Certain Units
- International Cooperation Administration

NON—FEDERAL Projects **NOT** Now in B.S.I.E.'s Coverage

- State Medical Research Programs
- N.Y. City Medical Research Program
- University, Hospital Research Supported by Their Own Funds
- Certain Smaller and Newer Private Foundations, Institutes and Voluntary Health Agencies

Supported Projects **NONE** of Which Are ny U.S., Foreign or International Source

Supported by Govt. Organizations	Supported by Foreign Private Sources
W. H. O. Other U.N. Specialized Agencies and Inter-Governmental Organizations	• Foreign Foundations • Foreign Universities • Foreign Hospitals • Foreign Voluntary Health Agencies

INTERNATIONAL HEALTH STUDY
SUBCOMMITTEE ON REORGANIZATION AND INTERNATIONAL ORGANIZATIONS
COMMITTEE ON GOVERNMENT OPERATIONS
U.S. SENATE MAY, 1960

The subcommittee asks, in effect: "How can scientists and granting bodies become better informed so that they channel their limited time and resources into the highest priority projects which will represent the least possible unknowing, i.e., unplanned duplication of past positive or negative results and of contemporaneous work by others?"

It would be my hope that WHO's outstanding Advisory Committee on Medical Research might be willing, after review in due course, to undertake exploration of this problem.

Toward that end, I am taking the liberty of submitting a copy of this message to Dr. James A. Shannon, particularly in his capacity as a member of that committee, as well as to a few of his colleagues with whom I have been informally in contact, such as Prof. Arvid J. Wallgren and Sir Harold Himsworth, all of whose judgment I so deeply respect.

It goes without saying that your own highly valued individual judgment would be most welcome.

I would not personally, of course, presume to submit a suggestion to the Advisory Committee. Perhaps, however, these informal transmittals of my views (which will, I believe, be shared by my colleagues) may be of interest to them, particularly to our well-regarded U.S. expert.

May I say that we of the U.S. Senate may approach this problem from two standpoints: (*a*) a national standpoint—wherein Congress, I believe, will want to make sure that the millions of tax dollars which it is authorizing to be spent abroad for research—fits in on a known, planned basis with the efforts by foreign governments and foreign private sources in the latter's own projects;

(*b*) from an international standpoint, wherein Congress would hope that intergovernmental and international nongovernmental organizations would seek optimum efficiency from their own research expenditures and efforts.

I understand the fact that there may be reluctance among some member nations to see WHO engage in: (*a*) administrative facilitating of others' research, as compared with (*b*) actual research under its own auspices, albeit through others.

I believe, however, that some administrative facilitating of research through a clearinghouse-type approach is inescapable and indispensable.

The whole of world research should be greater than merely the sum of its national parts. It is WHO which can further assure it so.

The status quo of under-communication and tardy communication, it seems to me, is not tolerable.

We are all aware that any one scientist's personal familiarity with the work of his colleagues, in the same or other countries, cannot be presumed to be sufficient in the face of literally scores or hundreds of contemporaneous projects in any given field.

The inevitable result is a serious time lag of lack of information during the two, three, four or more years between the dates that: (*a*) a supporting body (whether it be the U.S. National Institutes of Health, the Swedish Medical Research Council or any other such organization) approves a grant, and (*b*) the results of the project are finally published (if ever) in a paper in a recognized scientific journal.

It would appear that some form of international clearinghouse or clearinghouses should be explored, whereby the nations and the scientists, themselves, might agree on voluntarily furnishing certain minimal but essential data on current projects.

I, for one, feel that the World Health Organization could render further great service by being a catalyst toward consideration of the concepts of an international clearinghouse or clearinghouses.

It seems, further, that: (*a*) a relatively small expenditure of WHO's planning funds for this purpose could have an enormous "multiplier" effect. It could ultimately increase the scientific efficiency of literally tens of millions of dollars of research by and in other countries; (*b*) only WHO is in a position to spearhead collaborative exploration by many other international organizations such as CIOMS specialized medical groups like the UICC, etc.—each in taking up that phase of this problem with which it is most competent to deal.

I have no illusions as regards the formidable obstacles in many countries which may confront the international clearinghouse concept. Busy scientists already are plagued with the problem of filing reports; even the obligation of filing a 300-word-type summary may be regarded as burdensome to some. Problems of indexing, dissemination of data, etc., are also no doubt difficult, but not insuperable.

Submitted now are three items: (*a*) a brief background memorandum on the U.S. Bio-Sciences Information Exchange (which might serve as a precedent and as a U.S. "base" on U.S.-supported projects); (*b*) a 10-page draft finding on "International Indexing and Communicating of Data on Current Biomedical Research Projects"; and (*c*) an accompanying chart.

These various enclosures are respectfully submitted in present rough-draft form, since we are seeking to expedite the process of their improvement in successive drafts.

I will be most grateful to hear from you.

Kindest wishes.

Sincerely,

HUBERT H. HUMPHREY,
Subcommittee Chairman.

EXCERPT OF UNITED NATIONS REPORT

The subject of international registration was considered as part of a comprehensive review made by the United Nations, pursuant to a General Assembly resolution.

In July–August 1960 the Economic and Social Council of the United Nations favorably considered a 445-page report which had been prepared pursuant to a resolution adopted by the General Assembly November 14, 1958. (This, incidentally, was just about 3 months after the start of this subcommittee in its International Health Study.) The report was entitled "Survey on the Main Trends of Inquiry in the Field of the Natural Sciences, the Dissemination of Scientific Knowledge, and the Application of Such Knowledge for Peaceful Ends."

The following is the full text of the only paragraphs of the report which bear on the issue of registration of current research, irrespective of whether it is in the physical, social, engineering, life, or other sciences.

EXHIBIT 42

EXCERPT FROM REPORT OF APRIL 7, 1960, PREPARED BY UNITED NATIONS EDUCATIONAL, SCIENTIFIC, AND CULTURAL ORGANIZATION BEARING UPON PROBLEMS IN ALL OF SCIENCE ON INFORMATION ON CURRENT RESEARCH, "SURVEY ON THE MAIN TRENDS OF INQUIRY IN THE FIELD OF THE NATURAL SCIENCES, THE DISSEMINATION OF SCIENTIFIC KNOWLEDGE, AND THE APPLICATION OF SUCH KNOWLEDGE FOR PEACEFUL ENDS," PAGE 290

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6. INFORMATION SERVICE ON CURRENT RESEARCH WORK

Publications, however prompt, can give the research worker only a picture of the past. Yet it is essential for these workers, whether they operate singly or in groups, to be informed of work being done, on subjects related to their own, in other laboratories anywhere in the world. Owing to the speed of scientific progress and the magnitude of the resources in manpower and equipment employed in some institutions, it is a frequent occurrence for several workers and several laboratories to be dealing with the same subject by the same methods. This situation causes a lowering morale which may well become serious among research workers when they devote years to a piece of work without knowing whether, in another town or another country, other workers are not doing precisely the same thing. All too often whole groups see their efforts wiped out or, at best, seriously diminished in value when they read a newly published article setting forth all or part of the results they counted on achieving. At the present time, the only remedy for this state of affairs lies in the personal contacts made in the course of journeys, missions, or congresses, or simply by correspondence. But in many cases, and, above all, for young workers, this process is utterly haphazard and inadequate. The establishment of an information service on current research and on the specific activities of research workers, laboratories, and institutes would provide a complete solution. A service of this kind, limited to biology and relying on the good will of interested parties for all the information obtained, has already been in operation for several years at the Smithsonian Institution, under the title of "Bio-Sciences Information Exchange." It would be well to copy this initiative on a wide scale, first by establishing national services for the various branches of science and then by forging links between through an international bureau.

National services, partial or complete, would respond to requests for information and might publish from time to time a repertory of research subjects which had come to their notice and on which they possessed information.

All such information would reach the services concerned exclusively through the good will of research workers and institutions, for the exchange of information should be kept on a purely voluntary basis.

* * * * * * *

VIEWS OF SCIENTISTS ON POSSIBLE REGISTRATION OF FOREIGN PROJECTS

In exploring the possibility of registration of foreign-supported projects, our subcommittee has proceeded to contact a great many individual scientists other than those already mentioned. We have done so because we believe that no one should merely conjecture as to what scientists can use or may want. The only scientific way to go about determining scientists' needs and wants is by consulting scientists themselves.

If time permitted, we would attempt scientific sampling of opinion. Time does not permit and it has been difficult even to attempt soliciting as few reactions as we have. Nevertheless, we have made an attempt to compile others' views.

We felt that a good group with which to begin would be the scientific directors of leading American voluntary health agencies. Virtually all of such agencies now register their projects with BSIE. So we posed to them the problem as to what they would think of the concept of some sort of registration of foreign-supported projects.

We asked this question of the scientists in their capacity as individuals, and not in an official capacity on behalf of their organizations. There follows an exhibit consisting of the full text of the initial replies received in response to our inquiry.

EXHIBIT 43

INDIVIDUAL VIEWS OF SCIENTIFIC DIRECTORS OF CERTAIN VOLUNTARY HEALTH AGENCIES AS TO POSSIBLE UTILITY OF INTERNATIONAL REGISTRATION OF FOREIGN SUPPORTED RESEARCH PROJECTS IN THE LIFE SCIENCES

AMERICAN THORACIC SOCIETY,
New York, N.Y., October 3, 1960.

DEAR SIR: The suggestion to establish a clearinghouse of scientific information which would include current reports on research being conducted outside the United States is an excellent one. I have discussed this with several of my associates and without exception, they agree that such a clearinghouse is sadly needed and long overdue.

If there is anything I can do to lend my support further to such an undertaking, I would be more than willing to do so.

Sincerely,

JAMES W. RALEIGH, M.D.,
Medical Director.

THE ARTHRITIS AND RHEUMATISM FOUNDATION,
New York, N.Y., October 7, 1960.

DEAR SENATOR HUMPHREY: Your letter of September 27 regarding an international clearinghouse of information has raised a number of interesting questions. In those aspects of basic research at present being explored in relationship to the rheumatic diseases, there does seem to be excellent communication between the scientists working on a particular problem in the United States, Canada, the United Kingdom, the Scandinavian countries, and Holland. There are a number of reasons for this, not the least of which is the frequent visits of personnel and exchange of fellows, etc., between these various countries. There is a much less successful exchange between scientists of the United States and those working in France, Italy, Germany, Austria, and Spain. The South American countries seem to fall about half way in between. As is to be expected, relatively little information is available regarding the basic research in this field going on behind the Iron Curtain. It is of interest, however, that those Russian scientists attending the meetings of the International League against Rheumatism which were held in Toronto in 1957 seemed to be fully conversant wtih the basic research going on in the United States of America.

I do not believe that anything can supersede or replace the actual exchange of scientists who are then able to sit down and talk with their counterparts and discuss mutual problems. A clearinghouse of information would give one the names of scientists interested in a particular problem and the institution in which work was being done. This could be the beginning of a further exchange of correspondence or visits. Certainly the information contained in such a clearinghouse, as you so rightly point out in your letter, could not give any details regarding the particular project itself.

My own views would be that with regard to arthritis and the rheumatic diseases in general, unless this international clearinghouse included the countries behind the Iron Curtain, it is unlikely that the amount of new additional information uncovered would be worth the expense of setting up such a bureau.

Because of the importance of this problem, however, I will send copies of your letter to the members of the Medical and Scientific Advisory Committee of the Arthritis and Rheumatism Foundation asking for their opinion. When I have received their comments and replies, I will send these along to your committee also.

Yours very truly,

R. W. LAMONT-HAVERS, M.D.,
Medical Director.

AMERICAN PSYCHIATRIC ASSOCIATION,
Washington, D.C., October 10, 1960.

DEAR SENATOR HUMPHREY: I have your letter of September 23, 1960, in which you request my personal comments on the question: "Do you believe that members of your distinguished organization might benefit from being able to inquire from some central clearinghouse or clearinghouses of information as to current specific research now underway throughout the world?" My personal reaction to this is that this is a service which the approximately 12,000 members of the American Psychiatric Association would find useful to some degree and those specifically engaged in research would find useful to a very considerable degree. There is no doubt but what it would be useful to people who have positions such as mine and have enormous difficulties correlating all the various sources of information related to this subject.

May I suggest that in the event you would like to have more detailed information from a group of men in this association who are given the responsibility for this phase of the association's activities, you may wish to contact the following members of the American Psychiatric Association Committee on Research, whose names and addresses appear below:

Dr. Milton Greenblatt, chairman, 74 Fenwood Road, Boston, Mass.
Dr. Eugene L. Bliss, Salt Lake General Hospital, 156–158 Westminster Avenue, Salt Lake City, Utah.
Dr. Leon J. Epstein, State of California Department of Mental Hygiene, 1320 K Street, Sacramento, Calif.
Dr. David A. Hamburg, National Institute of Mental Health, Bethesda, Md.
Dr. H. Azima, Allan Memorial Institute, 1025 Pine Avenue West, Montreal, Canada.
Dr. George A. Ulett, 1420 Grattan, St. Louis, Mo.

I hope this information will be useful to you in furthering your ideas and advancing the cause of international medical research.

You specifically request permission to quote my views, and you may do so so long as it is understood that these are my personal views.

In the event that you wish an official statement from the American Psychiatric Association, would you please indicate this in a formal request and I will be pleased to present it to the association for its consideration.

If I can be of further service, please do not hesitate to make your wishes known.

With best wishes, I am,
Most sincerely,

MATHEW ROSS, M.D., *Medical Director.*

THE MYASTHENIA GRAVIS FOUNDATION, INC.,
New York, N.Y., October 13, 1960.

DEAR SENATOR HUMPHREY: It is my privilege to be chairman of the distinguished medical advisory board of this foundation, and I know that I speak wholeheartedly for my associates when I say you have our complete endorsement and cooperation for a clearinghouse of scientific information which is being conducted outside the United States.

We work very closely with the Bio-Sciences Information Exchange, which in many instances has been of great value to me and my associates.

We quite agree with you that it is a problem to make current international research available to the scientists outside the United States. We think your clearinghouse will answer this purpose.

Please consider me at your disposal.

With all good wishes for the success of your undertaking, I am,

Cordially yours,

KERMIT E. OSSERMAN, M.D., F.A.C.P.,
Chairman, Medical Advisory Board.

INSTITUTE FOR MUSCLE DISEASE, INC.,
New York, N.Y., October 14, 1960.

DEAR SIR: We have read with considerable interest your recent communication in which it is suggested that a clearinghouse for data on biomedical research currently being carried out throughout the world might be of real value to investigators. There seems to be little question that such an agency could save investigators throughout the world much time and expense, and could bring to the public the fruits of their research much sooner than might otherwise be possible.

Muscular Dystrophy Associations of America, Inc., supports research projects in many foreign countries as well as throughout these United States. It also sponsors an abstract journal in which are summarized recently published scientific reports in areas of interest to the scientists supported by M.D.A.A. This abstract journal is distributed free of charge to research workers, medical schools, and institutions interested in biomedical research. All this, however, is not sufficient. It would be of tremendous value to research workers if they could ascertain what work is being done currently in their particular field of interest.

I am sure that I speak for the medical advisory board of Muscular Dystrophy Associations of America, Inc., and for various scientists working in this area of medical research when I heartily endorse the idea so effectively proposed in your letter. It seems appropriate for me to express in writing at this time what many of us have said by word of mouth many times previously, that workers in medical research and all those who benefit from such research, owe you and your colleagues many thanks for your leadership in supporting and furthering medical research throughout the world.

Very truly yours,

ADE T. MILHORAT, M.D.,
Chairman, Medical Advisory Board, Muscular Dystrophy Associations of America, Inc.

W. K. KELLOGG FOUNDATION,
Battle Creek, Mich., October 17, 1960.

DEAR SENATOR HUMPHREY: In general, I am enthusiastic about the idea of establishing a clearinghouse on research information. I am not familiar with the Bio-Sciences Information Exchange, but from the description I would say that it performs a good function and as far as the United States is concerned it is a matter of getting more agencies to voluntarily report to this exchange. While we in the Kellogg Foundation are primarily concerned with the application of knowledge and not with the support of basic research, I am sure that a good clearinghouse would avoid much duplication in research efforts.

When visiting with members of the foundation staff who have served on some of the study sections in respect to National Institutes of Health grants, they said that in innumerable instances it is evident the applicant is not familiar with the work that is going on or that has been done in the field of his contemplated research. I think every effort should be made to do away with duplication. It would appear that World Health Organization might be a logical organization to establish an information center abroad, and this would be a very logical function of World Health Organization. I would also think that such a center could be financed in the same way any other World Health Organization program is underwritten. I am sure that such a clearing-house would improve friendly relationships between research workers and serve as initial contacts between scientists working in the same areas. Further, I would think that such an information center might do more than just give out information on projects; it might become a center for international goodwill.

Since we are not supporting research, it is doubtful if such a center would be of much use to this foundation. Periodically we do get information on research being done in the United States, and of course we are on the mailing list of many organizations sending out research data.

I hope the comments herein contained may be of some help to you in this important project.

Sincerely yours,

EMORY W. MORRIS.

NATIONAL MULTIPLE SCLEROSIS SOCIETY,
New York, N.Y., October 21, 1960.

DEAR SENATOR HUMPHREY: I regret the delay in responding to your letter received October 1, concerned with exchange of current research information from oversea laboratories. Our staff has just completed a period of total involvement in a national chapter conference.

It is most desirable, of course, that effective exchange be made of information on research in progress and results obtained wherever that research is being carried on. I consider the keyword of that statement to be "effective." Gargantuan though the task would be, it is not enough that information be made available in terms of the name of the investigator, the subject under study, current—and ultimately final—results; there must also be means of effectively evaluating the caliber and validity of the investigation and the results. Numerous examples can be listed of research which reported sensational results of far-reaching import, but which on analysis and proper evaluation were found to be spurious. For tangential reasons, one must question the desirability of methodical dissemination of concepts and tentative findings on research in progress, since so frequently tentative results are proved invalid; this, of course, is the basic reason for extensive and thorough studies.

Of periodicals and books there is no end, so that all of us are overwhelmed in attempting to keep abreast of reports that come to us. This type of thinking raises the question as to whether it might be feasible to establish a central intelligence agency, so to speak, staffed by capable scientists having broad perspectives, whose task would be limited to that of studying, evaluating, and abstracting scientific material in each of the scientific disciplines involved, so that these digests, hopefully valid, would be available to laboratory scientists working in the respective areas.

As a laboratory worker found a report to be of interest to him in his work, he might then request the complete scientific article for full study.

This utopian source of intelligence is of very questionable feasibility. It would take some of the most capable and most needed scientists out of their laboratories and out of production. Rarely would we find a scientist capable of performing these functions effectively who would be willing to leave his laboratory for this work. The danger would be present that after having performed such functions for a time, out of contact with his own laboratory and independent thinking, he might well become less aggressive, original, and forward-thinking in his ability to evaluate the work of others.

The bureau required to perform this herculean scientific task obviously would be huge, even though it would be broken down into separate disciplines. Organizations such as this could only hope to be efficient; it is well recognized that the tendency is toward inefficiency.

Numbers of efforts are now going on, as you know, to bring together information on research in progress. We cooperate with the Biosciences Information

Exchange and receive its notices in the field of our interest. Among others Excerpta Medica offers a number of abstracting services. That organization, under contract with the National Multiple Sclerosis Society, abstracts scientific reports from the world's literature which are considered by the editors to have possible relationship to the problem of multiple sclerosis and the demyelinating diseases. As a service to the medical scientists engaged in research in this field, the society furnishes these reports to them approximately monthly.

I am sure you know that this large, vexing matter has been a subject of interminable discussion. One of the intensive considerations was made in 1957 in a conference sponsored by the Documentation and Communication Research Center of Western Reserve University, Cleveland. The findings of the conference are published under the title of "Information Resources," edited by Shera, Kent, and Perry, and published by Interscience Publishing Co., 250 Fifth Avenue, New York, N.Y. If you have not seen this publication, it might be a source of interest.

I wish I felt capable of giving helpful, hopeful suggestions. While there is undoubtedly a not infrequent lag, and too often information does not reach the researcher of work already done which would be helpful to him and his problem, I am not of the opinion that the present state of affairs is unhealthy. It is remarkable how well and with what speed valuable and particularly pertinent scientific findings are disseminated. This occurs not only through the many excellent scientific journals whose editorial boards in general carefully screen reports for validity, but a remarkable amount of exchange occurs in the scientific fraternity through personal conversations, exchange of correspondence, and especially through the many and increasing number of informational and international scientific congresses, conferences, and seminars. This process, in miniature, is effected also through the popular and valuable program of visiting and exchange scientists sponsored by several agencies, as well as by senior scholarships from and to the United States.

Kindest wishes.

Sincerely yours,

THOMAS L. WILLMON, M.D.,
Medical and Research Director.

THE NUTRITION FOUNDATION, INC.,
New York, N.Y., October 27, 1960.

DEAR SENATOR HUMPHREY: Replying to your enquiry concerning the value of a central clearinghouse of information concerning research activities outside the United States, I believe such a center would be of distinct value to scientists in this country, both with reference to their research activities and to facilitate adequate educational services on behalf of Government agencies, industry, and educational institutions.

Sincerely,

C. G. KING, *Executive Director.*

INTERNATIONAL ASSOCIATION OF GERONTOLOGY,
November 2, 1960.

DEAR MR. HUMPHREY:

* * * * * * *

I think that a central clearinghouse for information could be a useful tool for gerontology.

As you probably know, there are at least two publications which give information about gerontological papers published in the world. One is "Excerpta Medica, Section XX Gerontology and Geriatrics" published in Amsterdam, the second is "Index to Current Periodical Literature," edited by Shock and appears on the Journal of Gerontology.

Unfortunately both publications report on researches done in the past.

With kind regards,

Yours sincerely,

Prof. ENRICO GREPPI, *Past President.*

(NOTE.—This concludes Senator Humphrey's memorandum on international coverage of current foreign-supported projects.)

VIEWS OF INFORMATION SPECIALISTS

Senator HUMPHREY. I should like the record to reflect some of the expert observations which have been made by men who are experts in the science of information and documentation.

There will follow at this point a series of reprinted items. The first two bear upon prepublished information. The latter two bear upon documentation. I may say that our forthcoming committee print on the Federal Government and biomedical information will elaborate on documentation, as such.

The items are: (a) the text of a response from Prof. Allen Kent, associate director of the Center for Documentation and Communication Research of the School of Library Science, Western Reserve University; (b) an abstract from a preliminary report by Dr. Richard H. Orr, executive director of the Institute for Medical Communication, analyzing the metabolism of new scientific information. This report is based on a very important institute study as to what happens and does not happen, and when, as regards papers presented at meetings of cardiovascular and endocrine workers; (c) an article entitled "An Integrated Approach to Documentation" by Dr. Orr; (d) a reprint of an address by Dr. Calvin M. Mooers before the American Documentation Institute. Dr. Mooers commented on the problem of obstacles to the usage of any—I emphasize "any"—information retrieval system without specific reference to whether the system pertained to the life, physical, or other sciences.

EXHIBIT 44

LETTER OF OCTOBER 10, 1960, FROM PROFESSOR ALLEN KENT, WESTERN RESERVE UNIVERSITY, ON DISSEMINATING INFORMATION ON CURRENT RESEARCH

OCTOBER 10, 1960.

DEAR HUBERT: We have examined in detail the material that you sent with your letter of September 28, 1960, in connection with documentation problems on current research data.

There can be little doubt that the delay in disseminating information on current research is at least as much of a problem as that of identifying the results of past research that remain buried in the literature. I think that the experience we have gained since January 1, 1960, would bear out that premise, since the demand for information on current research in metallurgy and allied fields is a major factor in the mechanized searching service that is being supplied by us for the American Society for Metals (see enclosed newsletter).[8]

From an intellectual point of view, the systems and procedures used for analyzing, encoding, and mechanized searching of research data is the same whether it is current or old material. Therefore, the new problems involved in organizing current research data for rapid retrieval are organizational and political in nature. What is required is the decision to start. The systems and machines are available which can make a significant contribution toward solving the problem.

We are certainly interested in this phase of the problem. The center's resources in trained staff and facilities are available for help in any way that may be required.

Sincerely,

ALLEN KENT, *Associate Director.*

[8] Not reproduced herein.

EXHIBIT 45

ABSTRACT OF APRIL 1960 OF A PRELIMINARY REPORT ON METABOLISM OF NEW SCIENTIFIC INFORMATION IN PAPERS PRESENTED AT SCIENTIFIC MEETINGS [9]

By Richard H. Orr, M.D., Executive Director, Institute for Advancement of Medical Communication

To investigate the metabolism of new scientific information, questionnaires were sent to the authors of 463 papers presented or read by title at two important meetings for cardiovascular and endocrine research workers. The preliminary findings indicate that, of the approximately 60 percent of authors responding, about one-third submitted their papers for publication before, or within 6 months after, the meeting. The interval between submission and publication was around 6 months. Less than 60 percent of the papers on which the followup is complete were published within 2 years. The study is continuing and a sample of the authors will be interviewed before a detailed and comprehensive analysis of the data can be made. However, the major tentative conclusions are: (1) The factors determining whether and how soon an oral report is published after a meeting are related more to the personal characteristics and working conditions of the author than to the quality of work or to selection and publication delay by journals; (2) the similarity of findings in this study of biological research reports with available data on similar reports in the physical sciences indicates important common features in the metabolism of all new scientific information: (3) the technique of using oral research reports as tracers to study the flow of scientific information is practical and useful.

EXHIBIT 46

"AN INTEGRATED APPROACH TO DOCUMENTATION," [10] BY RICHARD M. ORR, M.D.[11]

Documentation may be defined broadly as the science of storing and retrieving information. What relationship does communication bear to documentation? The process of communication involves a sender, transmission, and a receiver. In many forms of communication, the messages are recorded in a permanent or semipermanent form. These then require provision for storage and retrieval. In these terms it would appear that documentation is only a small part of the communication process and operates somewhere in the transmission phase. However, since it is implied in the definition of documentation that any system should be usable by human beings, the documentalist cannot ignore the sender and the receiver of the recorded information he is entrusted to handle. When these two elements are brought into consideration, documentation becomes a special phase of communication.

Now that I have established a rational excuse for talking to you about communication rather than about documentation, I want to go even further afield and speak only about my specialty—medical communication. The communication problems in medicine are very similar to those in the other sciences, especially the applied sciences. I will leave it to you to see the parallels in your own fields of interest.

Many medical scientists and practising physicians believe that a breakdown in our present methods of medical communication is imminent. Two major symptoms of incipient crisis already plague us. First, at no time in the history of medicine has the gap been wider between what the practicing physician *could and should* know to take maximal advantage of medical progress and what the average doctor *does* know and use in his daily practice. Second, lack of efficient and rapid communication between research workers is resulting in increasing duplication of effort as the magnitude of medical research grows. The limiting

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[9] Presented at the Annual Meeting of the American Documentation Institute, Oct. 22–24, 1959, Lehigh University, Bethlehem, Pa. This study was supported in part by a grant from the National Science Foundation.

[10] Presented to the Potomac Valley Chapter of the American Documentation Institute, June 5, 1958. Reprinted from American Documentation, vol. X, 1959, p. 214.

[11] Executive Director, Institute for Advancement of Medical Communication, 33 East 66th St., New York 21, N.Y.

factor on the growth of productive research is no longer money, but rather trained manpower. We are only beginning to appreciate the extent to which waste of this precious resource results from the present cumbersome and slow methods by which the individual research worker is supposed to profit from the experiences of his colleagues.

Clinicians are more and more frequently heard to say that they are so overwhelmed by the volume of literature they *should* read to keep abreast of developments that they "just give up." One hears medical research workers complain that, if they take the time to acquaint themselves with what others have done, or are doing, they have no time to do any work themselves. Often it seems quicker for them to work out a problem themselves than to find out whether someone else has already solved it.

The common cause of these two grave symptoms is the phenomenal growth of knowledge. Since the turn of the century, medical, like other scientific knowledge has been increasing at an exponential rate, but our methods of communicating this vastly increased amount of information among physicians and medical scientists have changed little during the same period. We continue to rely mainly on our traditional means of transmitting information, the scholarly publication and the scientific meeting, despite evidence that we have long since passed the point of diminishing returns in our attempts to increase the capacity of our present system by merely increasing the number of journals and meetings.

When I speak of the capacity of the system, I do not mean the speed of the printing presses. The capacity of a communication system depends on the sender and receiver as much as on the rate at which messages can be transmitted. Merely increasing the transmission rate gives no help, if the receiver cannot absorb the increased flow. Yet this is exactly what we have done. The printing presses and the organizers of scientific meetings have far exceeded the medical scientist's and practitioner's ability to assimilate their output.

As modern medicine developed, specialization temporarily solved [12] the problem of handling the flood of new information. Physicians and medical scientists learned more and more about less and less; likewise the organs of communication became more specialized. Specialized societies, with their inevitable meetings and journals, were formed at an ever increasing rate.

This expedient worked for a while. But the divide-and-conquer technique has now outlived its usefulness. The practicing physician can hardly become more narrowly specialized than he now is and still treat patients to their satisfaction as well as to his. In fact, there is a strong trend away from narrow specialization. We are beginning to realize that good medical care means treating the whole patient, not just one organ. Nevertheless, today even the most highly specialized physician cannot keep up with everything in his own narrow field. If this is true for the specialist, the more serious plight of the general practitioner is obvious. To keep up with only the more important developments requires reading more journals and attending more meetings than he possibly has time for.

The research worker is in an even less enviable position. If he is to avoid unfruitful duplication and benefit from the work of others, he should know *everything* that is going on in his field, not just what is most important. It has been estimated that a worker in cardiovascular research would have to attend at least 15 meetings a year and read 20 to 30 journals if he were to learn of only 80 percent of the research going on in his field in this country alone. In addition, as in clinical medicine, the trend in research seems to be away from narrow specialization and toward multidisciplinary approaches to research problems, with the result that the research worker's, as well as the clinician's task in keeping up is compounded.

Of course medicine, or even science in general, is not alone in having these problems. Our entire culture has become more and more dependent upon rapid and efficient systems of communication capable of handling greater and greater quantities of information. New techniques and media have been developed to meet these needs, and a whole new science devoted to communication has emerged. Some of these innovations are beginning to be adapted for use in scientific communication, especially in the physical sciences. However, they have had little use as yet in medical communication. As befits our conservative political reputation, we in medicine surrender tradition very grudgingly in areas

[12] We would say "obscured" rather than "solved."—Editor.

where scientific objectivity is not present. The tools are there for us to use; all that is required is to adapt them to our special needs.

This demands research and experimentation. Good research into better methods of communication, like any other scientific research, can take place only in an atmosphere of scientific detachment which little resembles the strongly emotional reaction so often evoked when scientists begin to discuss communication problems. A good example of this emotional reaction can be found in the proceedings of the Royal Society's 1948 Conference on Scientific Information when Bernal's proposal was discussed. Scientific societies and organizations seem to be too intimately involved with their communication problems to view them dispassionately. How then can true research and development be conducted?

It was in answer to this question that the Institute for Advancement of Medical Communication, a nonprofit organization, was founded early in 1958 on the premise that the problems of medical communication can be solved only if they are approached in the same manner as any other scientific problem. In addition to initiating its own research and development projects, the institute also undertakes to evaluate the possibilities of projects which may be submitted to it for consideration by other organizations. Also it advises any medical organization which seeks help from the institute on a specific communication problem.

The institute is intentionally a completely independent organization, with no financial or emotional investment in existing methods or media of medical communication. Development of usable communication systems, however, cannot take place in a vacuum. The motivations, biases, and needs of the intended audience of any new system must have first consideration; therefore, the directors of the institute are not professional "communicators." Rather, they are representatives of the three major consumers of medical communications—practicing physicians, medical educators, and research workers. The function of the institute's board of directors is to guide along acceptable and practicable paths any research or developmental projects which the institute undertakes. In this they are assisted by the staff of the institute and by an advisory board of experts in the various techniques and disciplines which are involved in medical communication—documentation, editing, motivational research, operations research, technical writing, graphic arts, television and radio production, medical illustrations, publishing, printing, etc.

To illustrate the institute's approach to a specific problem, consider the problem of improving communication among research workers. Any communication need can be analyzed into three questions: What is the nature of the material to be transmitted? What are the requirements of the transmission process? What are the needs of the specific audience? I will consider the research worker's needs first because the answers to the other two questions can be derived directly from the answer to the first.

The medical scientist working on hypertension, for example, needs to know the details of all research currently being conducted on hypertension throughout the world and in all the disciplines—physiology, anatomy, biochemistry, pharmacology, and so on. He wants to know what his colleagues are doing *now* and not 12 to 18 months after the work is finished and is finally reported in the standard journals. This information must be in great *detail*, especially with regard to any new methodology which he may be able to use in his own laboratory. He wants to see *all* the data which was collected. He is often more interested in the way the experiment was conducted and the reasoning used than in the conclusions. He feels he is qualified to draw his own conclusions on work in his field. He should be able to get all this information without poring over a vast amount of literature, 99 percent of which does not interest him. Yet he must be sure that he sees *everything* that pertains to his work. Lastly, he needs to get this information economically, and in a form suitable for building his own personal, highly specialized reference library. This library should be compact so as to fit into the usually limited space of a laboratory; and he should be able to retrieve rapidly any precise bit of information he needs, without requiring the services of a medical librarian.

But it should also be decided what is not essential to him, for it may be necessary to compromise, to sacrifice some nonessentials to meet all of the research worker's important needs in a practicable and economical system. He does not require that his information appear on expensive paper and in elegant format. The material does not have to be carefully edited. This may sound heretical, but careful analysis has convinced me that this is so. The two chief functions of editing are selection and improvement. The editor tries to select the more worthwhile contributions, because he does not have space to

print everything and because he believes that he must protect his readers against unnecessary trash. The editor then reworks the selected manuscripts to make the reader's job easier and quicker and to increase the probability that readers outside the immediate field of the author will understand the contribution. But the research worker who wants fast information about the work going on in his own field does not have to be protected in these ways. He is the most severe of critics *in his own field* and is probably better qualified to judge the quality and importance of the information presented than are most editors. If he must choose between speed of publication and readability of papers, he will choose speed. Jargon and cryptic sentences, when they pertain to his own field, are not a problem to him. He is accustomed to the shoptalk of his colleagues.

Let us see how the *present* publication system meets these requirements that we have set up. The reports our worker in hypertension wants are, at present, scattered throughout a large number of separate publications. He must cull what he seeks from a vast amount of material in which he has not the slightest interest. He cannot wait for the abstracting and indexing services to tell him where to look. For, even if they were perfect and completely comprehensive, which they are not, the work is usually at least 2 years old by the time it gets into this digested form and much of its potential value for him, in his day-to-day work, has been lost. Today, the reports he needs are usually to be found in journals printed on expensive paper and in a format designed to preserve the contents as if they were precious historical documents, rather than the perishable material which the results of most modern research are. The subscription rates of the journals he must read may not be exorbitant for practicing physicians; but they are *for him*, especially when one considers the number to which he must subscribe. He finds that many of the journals favor the interests of the clinician rather than his own. The editors, to conserve space, remove large portions of the details of technical methodology and shun the presentation of voluminous data, because they are of limited interest to clinicians; but these are the very things he wants most. To collect a compact reference library, he must either tear out the articles he is interested in or request reprints from individual authors, a process leading to further delay. The resulting library is difficult to keep in order and time consuming to use. Worst of all, the whole cumbersome system is too slow for his needs. It is geared to the pace of the 19th century, when research was largely a gentleman's pastime, and a delay in publication of a year or two made little difference as long as the research worker's priority was established.

Here we have a communication problem clearly stated. We know the requirements of an ideal system and the techniques which are currently available. Can we arrive at a logical solution which gives promise of being workable? This is a problem we can approach with as much scientific detachment as the question of how to send a rocket to the moon. But the solution which is to be developed must be more than merely logical. It must also be acceptable in terms of the research worker's psychology. Judging the acceptability of any solution and getting the reactions of prominent research workers is always valuable. However, a statistically valid poll on a question of this complexity is not possible. Therefore, the answer can be arrived at only by trying the proposed scheme on a pilot scale with a representative audience. Modifications as necessary, can then be made. If the experiment fails, something has been learned. In science, one may learn as much from an experiment which fails as from one which succeeds.

A promising approach to this problem has been carefully worked out by the institute, and an application for a research grant to test it on a pilot scale is pending with agencies which support medical research. I will not describe the details of this proposal here, for I have used this project only to illustrate the institute's philosophy and approach. I have, however, appended a statement of purpose and an outline of the organization of the institute itself.

EXHIBIT 47

MOOERS' LAW

OR, WHY SOME RETRIEVAL SYSTEMS ARE USED AND OTHERS ARE NOT [13]

Remarks by C. N. Mooers during the panel discussion at the Annual Meeting of the American Documentation Institute at Lehigh University, Bethlehem, Pa., Saturday, October 24, 1959.

Some critical remarks about retrieval systems—and the environment in which they are used—would seem to be in order at this point. We are all aware that some retrieval systems, although technically rather poor, nevertheless receive intensive use; while other systems, sometimes technically very much better, receive very little customer use. Why is this?

I should like to explain this situation by advancing for your consideration a principle or law of behavior which I believe governs the use of retrieval systems. We have all heard of "Parkinson's law" governing some of the more preposterous features of the exponential growth in size of governmental offices. In analogy, we might call the following principle "Mooers' law" for retrieval systems.

During this meeting, we have been discussing ways in which to make retrieval systems perform more efficiently, search more rapidly, operate on larger collections, and so on. However, as we furnish our customers more and better retrieval system performance, can we be assured that they will make any greater use of the systems? In my estimation, the answer is "no."

It is my considered opinion that our customers will continue to be reluctant to use information systems—however well devised—so long as one feature of our present intellectual and engineering climate prevails. This feature—and its prevalence is all too commonplace in many companies, laboratories, and agencies—is that for many people it is more painful and troublesome to have information than for them not to have it. For such people, recourse to a retrieval system which is efficient at putting information into their hands is an action that they will tend to avoid. Thus we have,

Mooers' law: An information retrieval system will tend not to be used whenever it is more painful and troublesome for a customer to have information than for him not to have it.

If this law is true—and I believe it is—this is indeed a pessimistic and even a cynical conclusion. In the building and planning of our information handling and retrieving systems, we have tended to believe implicitly, and to assume throughout, that having information available was always a good thing, and that all people who had access to an information system would want to use the system to get the information. It is now my suggestion that many people may not want information, and that they will avoid using a system precisely because it gives them information. I shall now try to justify my assertions.

Having information is painful and troublesome. We all have experienced this. If you have information, you must first read it, which is not always easy. You must then try to understand it. To do this, you may have to think about it. The information may require you to take decisions about it or other information. The decisions may require action in the way of a troublesome program of work, or trips, or painful interviews. Understanding the information may show that your work was wrong, or that your boss was wrong, or may show that your work was needless. Having information, you must be careful not to lose it. If nothing else, information piles up on your desk—unread. It is a nuisance to have it come to you. It is uncomfortable to have to do anything about it. Finally, if you do try to use the information properly, you may be accused of puttering instead of working. Then in the end, the incorporation of the information into the work

[13] Zator Technical Bulletin 136, December 1959.

you do may often not be noticed or appreciated. Work saved is seldom recognized. Work done—even in duplication—is well paid and rewarded.

Thus not having and not using information can often lead to less trouble and pain than having and using it. Let me explain this further. In many work environments, the penalties for not being diligent in the finding and use of information are minor, if they exist at all. In fact, such lack of diligence tends often to be rewarded. The man who does not fuss with information is seen at his bench, plainly at work, getting the job done. Approval goes to projects where things are happening. One must be courageous, or imprudent, or both to point out from the literature that a current laboratory project which has had an expensive history and full backing of the management was futile from the outset. At a desk, an author of a technical report, by not making a prior literature search, and by omitting citations to earlier work, can prepare his reports so much faster, with the additional advantage that people will think the ideas presented were new and were his own. Unlike a meeting I attended in England, at engineering meetings in this country it is not considered quite proper for a member of the audience to get up and to give out in plain language the citation and facts showing the lack of content or novelty in a paper.

Where not using information is rewarded, instead of being punished, we can expect that any information retrieval system will be used only with reluctance. On the other hand, there are situations where the diligent finding and use of information is stressed and rewarded, and where failure to find or to use information is severely punished. In such places, we can expect retrieval systems to be actively used and we can expect pressure from the information users themselves for better systems. This turns out to be true in practice.

(These comments are excerpted, with modifications, from the report "Information Retrieval Selection Study, Part II: Seven Retrieval System Models," by Calvin N. Mooers, Zator Co., 140½ Mount Auburn Street, Cambridge 38, Mass., to be published as Report No. RADC–TR–59–173, contract AF 30(602)–1900.)

COMMENTS BY FORMER SURGEON GENERAL

Senator HUMPHREY. Let me also note that no less an authority than a former Surgeon General of the U.S. Public Health Service, a man whom we naturally and rightly hold in the highest regard, Leonard Scheele, M.D., has notably addressed himself to the need for improved communication, including communication of negative results. In an address reprinted in the June 1959 issue of the Journal of the American Osteopathic Association, under the theme, "Medical Research—Unfinished Business," Dr. Scheele soundly, in my judgment, commented:

Communication.—Much scientific information is accumulating and much more will accumulate in the future, compounding the problem of dissemination and digesting of information by scientists and the bringing of information to practicing physicians. Not only is there need for finding better methods of communication in the United States, but on a worldwide basis. At the moment, few negative results are published. Ways must be found to publish such results to avoid unnecessary duplication.

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What is needed is a "results pool" for all health research into which could be fed, on a completely current basis, not only the conclusions drawn from experimental data, but also the raw data and complete details of any new technical methods developed in the course of experimentation. From this pool, a researcher should be able to draw selectively the information he desires at the moment, with a minimum expenditure of time. This will not be simple to accomplish, but work in this direction is necessary.

INFORMATION RECORDS ONLY A TOOL

Senator HUMPHREY. In ending this phase, let me say that records do not coordinate; men coordinate. Records do not research or create: men research and are creative. Records are just a tool. BSIE is just a tool. It can be used at 10 percent of its capacity or at close

to 100 percent. It can be used for relatively elementary tasks or for highly imaginative and creative analysis.

Even if it is used to the fullest, as we believe it should be, the problem of Federal coordination will still be a vast one. BSIE usage is but one phase of the problem. But, I for one, raise the question: "Is agency reluctance to date to use BSIE at fullest and highest capacity a symptom—a sign—of something deeper, as regards problems of interagency cooperation?"

We have spent this much time on BSIE and information systems not because they are the most important aspects of interagency coordination, but because a case history of the evolution of a system like BSIE—its problems, achievements, and opportunities—provides helpful insight into more fundamental interagency processes.

COMMITTEE PRINT ON RADIATION

Very good. Now, continuing in our discussion, there are about four of you that have not participated here and I want to get an observation or so from each of you. Dr. Dunham.

Dr. DUNHAM. Yes, sir.

Senator HUMPHREY. First let me thank you for the cooperation you have extended to the committee in the print we are going to publish on "Radiation Research in the Life Sciences." This is a splendid document. It is coming out shortly, in about 4 weeks, and we are very appreciative of the assistance you have provided.

I want to thank also Dr. Walter Claus, who is here today, for the spadework done on this publication, all the detailed effort.

As you know, one of the tentative findings, as indicated in the galley proofs of this report, is that the Atomic Energy Commission is acting soundly in bringing together for the first time information on all of the radiation research projects now being performed in the laboratories throughout the United States. That is the policy now, is it not, in AEC?

Dr. DUNHAM. That is correct, sir.

Senator HUMPHREY. You will recall that we found that there are hundreds upon hundreds of relatively unreported projects, not reported to the AEC in the form of project summaries, and not reported to BSIE. While the information did come to Washington on these projects, it did not come, as I understand it, in a usable form until the first progress report was received later on for publication in "Nuclear Science Abstracts."

I would like to ask, therefore, how you gentlemen are getting along in your program to bring together in Washington in usable form summaries of all current radiation research for reporting to the Bio-Sciences Information Exchange?

Dr. DUNHAM. Senator Humphrey, we began working on this about a year ago, and we have explored with the laboratories and the scientists there the way in which it would be less burdensome to them. They have to do a great deal of paperwork in preparing our budget.

What we are trying to do now is to work out a system whereby they can both fulfill our needs for budget purposes and the needs for the information in a form which will be usable by Dr. Deignan in the Bio-Sciences Information Exchange.

As soon as Dr. Claus has finished with his assistance to you—and we have been very happy to make him available for that print that is now

in press—he will be chairman of a committee of my own staff which will actually iron this out and put the thing into operation.

Senator HUMPHREY. So we can look forward in a reasonable period of time to having all of this material made available in a usable form; is that correct?

INTEREST OF COMMITTEE HELPFUL

Dr. DUNHAM. Yes, sir, and I would say that the fact that your committee has expressed a keen interest in this will make it much easier for us in dealing through the channels with our scientists—most all of whom are on contracts. It will make it much easier a pill for them to swallow.

Senator HUMPHREY. Yes, and may I ask you to assure them that the interest is not only keen, but sharp and persevering.

Dr. DUNHAM. Fine.

PROBLEM OF COVERAGE OF FOREIGN PROJECTS

Senator HUMPHREY. And we appreciate what has been done thus far. I mentioned a while ago, Dr. Dunham, the example of radiation research in Germany. What plans do you have, if any, to record or to bring together current radiation research in the life sciences in other countries, which presently does not come to your offices?

Dr. DUNHAM. After having had an opportunity to look over the material that did not come in, shall we say, I can think of several approaches. One is through the U.N. Scientific Committee, which does assemble information on the biological effects of radiation. The other would be through either WHO or through IAEA. I do not know which organization will move fastest, but I think one of them should pick up the ball and start running right away.

Attention should be called to the UNESCO report of April 7, 1960,[14] which surveyed main trends of scientific inquiry throughout the world and problems of the dissemination of scientific knowledge. It appears that UNESCO has already been giving serious attention to the problems which are being discussed here today.

Senator HUMPHREY. I notice we have a fairly good compilation which, of course, has been made available through your cooperation, on both U.S. projects and foreign projects about which we have information. But there are additional nations in the free world with atomic energy programs whose research expenditures are not known, indeed not only their expenditures but obviously not the nature of the projects.

Brazil, Chile, Colombia, Costa Rica, Cuba, El Salvador, Peru, Venezuela—at least some of these countries not now covered might be able to make a very substantial scientific contribution in this area. You are engaged now, am I correct, Doctor, in attempting to get a workable mechanism that will bring this foreign information to our attention?

Dr. DUNHAM. Yes.

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[14] See exhibit 42.

NATIONAL SCIENCE FOUNDATION PUBLICATION

Senator HUMPHREY. Senator Muskie, do you have anything on this? We may come back to you in a moment here, Dr. Dunham, but I want to ask Dr. John Wilson, of the National Science Foundation, a point or two in reference to some of the work that he is engaged in.

You publish, Dr. Wilson, a comprehensive publication entitled "Unclassified Federal Grants and Contracts in the Life Sciences." That is correct, is it not?

Dr. WILSON. Yes, sir.

CATEGORY AS COMPARED WITH SUBJECT INDEXING

Senator HUMPHREY. I notice there is no index in this publication, although it lists thousands of projects. How then can an investigator easily find what he is looking for? Is it not a fact that he must look through several major categories by which the projects might possibly be listed, and that he may have to review literally hundreds of individual titles before he finds, if at all, the one that he is really interested in?

Dr. WILSON. We felt in making this up that the broad category breakdown was a sufficient index for scientists' use. The publication is broken down in two ways, as I recall it. I do not have a copy in front of me. For the use of research administrators, we have broken it down by, I believe, State and school, so you can refer to it if someone asks, "Who is doing what at such and such a place?"

Senator HUMPHREY. Yes.

Dr. WILSON. With reference to the subject matter, it was our feeling that the category system is in itself a sort of index, and if you get much finer than that, then your total workload increases tremendously—and I might say that this compilation is a tremendous workload and I would like to comment further on that point because you raised the question of print out. We felt that the broad category system was not very onerous for anybody who wanted to find something in a subject matter area. I think if you are familiar with the area, it does not make too much of a task actually. I do not think an index in any finer breakdown really would be worth the effort it would take to compile it.

Senator HUMPHREY. In other words, you are saying for a man that is busily engaged in a particular field, endeavor or category, that he will be able to——

Dr. WILSON. Without undue burden.

Senator HUMPHREY. Find the information?

Dr. WILSON. Yes, and I think anyone who is administering a research program would be able to do the same thing. We did not feel a further breakdown in the index was worth the effort.

Now, on this publication, I might say that in the Foundation, in the Biological-Medical Sciences Division, when we first started some few years ago to try to pull this information together, it was our intention of trying to get in a single bound book an up-to-date listing of grants

of all Federal agencies. We had to stop at the unclassified projects for our purposes. It has proven to be a tremendous task, because while we were trying to catch up with ourselves, research grant budgets were also increasing, so we were always running but never getting ahead.

NEED FOR MACHINE PRINT OUT

It occurred to us last year that this was not going to be a job which we could continue to do by hand compilation, and therefore we turned to Dr. Adkinson's group. Together with the BSIE people, there was suggested the possibility of putting this on some sort of a machine basis. I think it is absolutely unthinkable to try to do this on any other basis actually with the number of grants that are now being supported by the various agencies, and I would think that with the improved machine methods that are available to BSIE, that it would be no great task to turn out a print out once the system is set up.

So, as of last year we stopped doing this by hand and have turned it over to the Information Service which, in turn, has been working with BSIE toward, I hope, a machine print-out method for at least listing projects by title.

Senator HUMPHREY. Are you keeping a little pressure on?

Dr. WILSON. I have backed out in favor of Dr. Adkinson, but I assume he is keeping the pressure on. This is an information type of activity, and while we started it in the BSMS research division, we have since gotten out of it in favor of the information office.

NSF AND BSIE INDEXING

Senator HUMPHREY. This is a question that maybe you have touched upon. Is it not rather odd that the Bio-Sciences Information Exchange collects 300-word summaries—I believe that is about right, is it not, Dr. Deignan—and indexes them by many terms?

Yet a second Federal organization, the National Science Foundation, instead of using the summary and using the index, merely publishes the titles alone without the index?

Dr. WILSON. No, I do not think this is odd, Senator Humphrey. The purpose of the biosciences information subject category system is a multiple one. If we did this by multiple categories, our book would be many times as thick as it is now because a single project would be listed several times.

We were interested in listing the projects singly by geographic area and school and by a most appropriate subject matter category, and we would, I think, have quite a bit of agreement in terms of subject matter category with reference to primary filing system or primary category division with BSIE. We wanted a limited number of categories and we want it listed only once per project, so if you were interested in finding it, you see, listing it more than once would make it all the more difficult to make sure you were getting what you wanted when you were looking.

Now the category system problem is one which is never ending. If you have a dozen people talking about how you are going to index something, you will get a dozen different indexes. Believe me, we spent many, many hours threshing out what sort of an index or category scheme would be minimally time consuming, maximally useful with reference to people who get this publication. We referred to the

category system; we looked at all of the abstract journals, for example, and all of these have very fine indexes for the purpose for which they are gotten out. This was a compromise, as is every category system.

Senator HUMPHREY. Does the BSIE also maintain an index of these unclassified Federal grants and contracts in the life sciences?

Dr. WILSON. In the compilation of our book, we got a large percentage of the information via BSIE. Other parts of it we got directly from agencies, such as Agriculture, whose projects are not listed in BSIE.

CHECKING FACTS WITH AGENCIES

But the point at question here was that we used BSIE information when it was available, with the permission of the other agency, because I think in the charter of BSIE it is necessary to get the permission of the other agency. One other point: Once getting information via BSIE, we would go back to the agency and check for up to dateness and that sort of thing, because there is a timelag in the registration and all of that. So that once we got information from BSIE and had it categorized, we would take it back to the other agency for a very quick rundown to see that the latest projects were included.

Senator HUMPHREY. Would your work have been simplified, economized, and helped had the BSIE been in prompt possession of more information than you had?

Dr. WILSON. Oh, I can't truthfully say that it would have made a great deal of difference. A trip to BSIE or a trip to the Department of Agriculture is just about the same time, and we got equally good cooperation from everybody.

Senator HUMPHREY. You had to make two trips, though, didn't you?

Dr. WILSON. You had to make many trips. You couldn't do this all in one trip anyway, so you are going someplace every day while you are gathering the information.

I see your point all right: If it is all in one place you go back to that same place. But I would add this: If it is all in one place, I think the point you are making is not a valid one, but the point I am about to make I think is valid. If it is all in one place, then there is no need for another agency to do it. You ask the agency that has it all to put it on machine cards, pull it all out on the same basis and print it out, because it is all there.

Senator HUMPHREY. Yes. What is wrong with that?

Dr. WILSON. There is nothing wrong with that. This is the evolutionary step which I hope is about to take place now on the basis of our own experience in attempting to collate all the projects that are actively supported by various Government agencies.

When we attempted this at first, some of us thought we were attempting the impossible to pull it all together, because there are a great number of projects. Once we started it, it appeared to be feasible.

It also developed into a terrific workload to do this manually. So as I said before, last year it seemed that the only reasonable way to do this was to do it by machine methods. If machine methods are available in the installation of the information, then it is obvious that

you can pull it out this way. So I think if BSIE with machine methods puts information about projects into its system, it obviously can pull them out. That is the reason I was suggesting via Dr. Adkinson that we get out of this manual operation, turn to BSIE for a print-out kind of thing, which is what our book is actually, a print-out.

Senator HUMPHREY. Yes.

Dr. WILSON. And do it that way as an economic measure both in terms of time, effort, money, and everything else.

Senator HUMPHREY. Very good.

Now, apropos of our discussion on this matter of publications listing current research, I shall ask that there appear in the record at this point a staff memorandum which I asked Mr. Cahn to prepare.

EXHIBIT 48

STAFF MEMORANDUM ON FEDERAL PUBLICATIONS LISTING CURRENT RESEARCH

At the direction of the chairman of the subcommittee, information is being and has been compiled on the subject of the extent to which Federal agencies now disseminate information regularly or irregularly on their current research projects through printed or otherwise reproduced publications.

COMPILATION BY FEDERAL ADVISORY COMMITTEE

As an initial step, an inquiry was conveyed to the Federal Advisory Committee on Scientific Information. It was asked to inquire of the respective agencies as to what publications they issue of this nature to research administrators, scientists, or anyone else.

A response, as compiled by the Secretariat of FACSI (as the Committee is known), follows this memorandum as attachment A.

ILLUSTRATIONS OF PUBLICATIONS

For present purposes, we may note in further detail the contents and the sources of a few of the Federal publications which inventory current research.

Titles and descriptions of several such publications follow:

(*a*) "Activities of the National Institutes of Health in the Field of Gerontology," January 1960, prepared by the Center for Aging Research, Division of General Medical Sciences, National Institutes of Health, Public Health Service—a report listing research grant and training projects active on January 31, 1960, and intramural research projects carried on during the calendar year 1959.

(*b*) "Research Related to Children—Studies in Progress on Growth and Development, Personality and Adjustment, Educational Process, Exceptional Children, the Family, Social, Economic, and Cultural Influences, Health Services, Social Services," issued by Clearinghouse for Research in Child Life, Division of Research, Children's Bureau, Department of Health, Education, and Welfare.

(*c*) "Water Supply and Pollution Control—Research Inventory—Active Projects—1958," prepared by Engineering Resources Program Division of Engineering Services and Division of Water Supply and Pollution Control, Public Health Service—a report summarizing 280 water-supply and pollution-control research projects active in the United States during 1958.

PROBLEM OF OBSOLETE CONTENTS

One fact already ascertained is that several of the inventories of so-called current research are actually somewhat obsolete by the time they are distributed. There may be a time lapse of 2 years or more between the date of the publication and the time it gets into the hands of potential users.

LIST OF PUBLICATIONS INVENTORYING PHYSICAL SCIENCES RESEARCH

It should be noted that the subcommittee's inquiry on publications inventorying current research in the life sciences is paralleled by its similar inquiry as regards comparable Federal publications for the physical sciences. FACSI—

the Federal Advisory Committee on Scientific Information—has compiled therefore a list of similar publications outside the life sciences.

That list is expected to be reproduced in the forthcoming committee print on "Coordination of Information on Current Federally-Supported Research and Development Projects in Science and Engineering."

OBSERVATIONS ON LIST OF BIOMEDICAL PUBLICATIONS

A number of preliminary observations are submitted as regards the overall list compiled by FACSI and reproduced as attachment A.

1. Several of the Federal agencies seem relatively uncertain of what constitutes a "publication listing current research."

A number of agencies responded to FACSI by listing publications whose very titles indicate at least to this staff that the items are not genuinely of a character "listing current research projects." We have nonetheless included them in attachment A in order that the viewpoint of the agencies would be reflected herein.

Conversely, it might be noted that the staff has noted several publications which should have been reported by the various agencies to FACSI but which were not. One such is "Research Related to Children," another is the NIH publication on gerontology projects, both of which are referred to above.

It should also be noted that the Department of Health, Education, and Welfare did not refer to National Heart Institute publications on current research. (See list (p. 233) of "Documents Summarizing National Heart Institute Research Projects." One such document is "Currently Active Research Government Projects Investigating the Role of Estrogens in Atherosclerosis (Fiscal Year 1959)," which is, incidentally, identified as being issued for administrative or intramural use only.)

2. Of the publications which are listed, some are issued regularly, others irregularly. The regular publications are issued weekly, monthly, quarterly, or annually. A few are printed; most are multilithed or mimeographed. Some consist merely of a listing of project titles; others contain a summary of each project in several hundred words.

3. It would not be possible at this time to estimate to what extent and in what detail the 23,000 or so active federally-supported projects are covered by publications on this list. NIH, with the largest total of current projects—around 12,000—lists extramural grants only in the series, "Public Health Service Grants and Awards," and the listing is by title only.

INVESTMENT BEING MADE

4. Even, if, for our purposes, we were to exclude from the overall FACSI list those publications which by their nature do not appear to merit inclusion, it is clear that several dozen publications issued by the Federal Government do attempt to cover current biomedical research. This large a number confirms that the Federal Government is indeed now making a certain investment in bringing together such information.

ADMINISTRATIVE PURPOSE OF FEDERAL PUBLICATIONS

5. A basic question arises: What is the intended and actual use of this series of publications? Clearly the most widespread use, with but a few exceptions, is apparently for administrative-archival purposes. Federal agencies, for a variety of internal and external reporting and accounting objectives, catalog their work in this manner "for the record."

The staff has not had time to attempt a review as to the number of copies which are printed of these various publications nor of the distribution pattern. From such few facts as the staff has been able to compile within a limited time period, it appears that with the exception of a handful of larger type reference publications, such as U.S. Government Technical Reports, etc., most of the specialized publications on the list are printed in comparatively few copies, since they are apparently intended to be distributed only to interested Federal offices.

But what happens in the "interested Federal offices"?

Are the publications actively used by research administrators in those offices? Or are the publications merely glanced at for a few moments and put on a library shelf to be used rarely, if ever, thereafter? No one can now attempt a definitive answer to that question.

It may, however, be stated that the staff has received few reports that this series of specialized publications is actually put to active use by research ad-

ministrators outside the individual department or agency which prepares them in the first place; that is, the staff has heard of little intensive interagency consultation of the series. Only a detailed questionnaire and interviews could however substantiate or refute that tentative observation.

POSSIBLE USE BY RESEARCHERS

A further question arises: Is there any intended, actual, or possible use of specialized publications of this nature by biomedical researchers, i.e., by working scientists (rather than by administrators) in order to keep in touch with developments in their field?

The answer to this question too could only be supplied after careful and detailed study. It tentatively appears, however, that comparatively few of the highly specialized publications are so intended or are at present used for this purpose outside a given department or agency which prepares a particular publication.

(Obvious exceptions are the Children's Bureau Clearinghouse publication, the Department of Commerce publication on Government technical reports and a few others which by their very nature are intended for broad use and do receive considerable use.)

FEW INDEXES AVAILABLE

For one thing, material within many of the specialized publications appears rarely to be organized in a manner which would encourage or permit ready and broad research reference. Relatively few of the publications, which we have seen, include an index. Also, the fact that relatively few copies appear to be printed (of those publications which we have noted) indicates that the publications are not intended for widespread distribution.

It is also noteworthy, that no list of publications of this nature has apparently ever previously been made available for broad-scale distribution. Only a comparatively very interested source, e.g., perhaps a central biomedical library of a Federal agency, itself, could know that this number of publications existed, in the first place. The large number of Federal sources—departments, agencies, divisions, laboratories, etc., which prepare this type of publication—means that it would probably be difficult for the average source, particularly non-Federal, to keep up with, request, and receive the many agencies' output.

POSSIBLE USE CANNOT BE RULED OUT

Can it be presumed then, that because there appears on the surface comparatively little researcher-type use of the specialized publications, that no such use is possible or desirable? The answer to this question is that it cannot be answered at the present time. Because an information system or serial or group of serials may not now be used hardly means that it cannot be used or should not be used.

Because researchers say they are already "deluged" with publications on completed research does not mean that they should ignore or would "forever" ignore publications listing current research.

Professional literature on scientific information, however, appears almost devoid of references to active use of publications of this nature by researchers.

ANALYSIS OF USE STUDIES

The very subject of professional use studies as regards information publications and systems is itself both a significant and a controversial one. A considerable number of use studies (usually as regards data stored for and in the physical sciences) have been made under support by various Federal scientific agencies, principally the National Science Foundation.

No substantial use study as to this type of Federal biomedical publication has come to the staff's attention. A few such Federal publications have made an effort to determine the use to which they are put; but no substantial volume of scientific data exists based on any such evaluation of use.

Is, however, such a use study itself necessary and desirable? Those who would answer "yes" would contend that only by a use study can a case be made for or against Federal investment in the publication. The Senate Committee on Government Operations, under its mandate for budgeting and accounting, would understandably take strong cognizance of this viewpoint.

There are, however, contrary views on use studies.

We may note in this connection, certain observations made in 1958 in a helpful analysis by Mortimer Taube, under contract with the Air Force Office of Scientific Research. Dr. Taube directed his remarks to use studies of documentation systems. (He did not refer to publications inventorying current research.) Basically, he questioned the value of the use studies. His views are somewhat, albeit only generally, pertinent to the question of attempting to evaluate the use of Federal publications, such as those listed in attachment A.

Excerpts from the analysis issued by Documentation, Inc., entitled "An Evaluation of Use Studies of Scientific Information," December 1958, are, therefore, reprinted at this point:

A KEY DISTINCTION

Early in his analysis, a helpful distinction is made between "scientific productivity" and "productive science":

"A group of research workers busily and ignorantly duplicating one another's work and writing articles in journals which nobody reads are contributing to scientific productivity but they are not, thereby, productive scientists.

"What this means is that measures of effectiveness must involve judgments of value."

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He states his main point as follows:

"It is the contention of this paper that the provision of scientific information services is a professional activity and hence the value of such services cannot be measured by use studies. Those groups and individuals who have sponsored and carried out use studies are denying this professional character of scientific information service. They are, in effect, equating the work of editors, indexers, abstractors, authors, systems designers, etc., to that of purveyors of packaged tidbits whose value is measurable in terms of consumer response to their delectability."

OTHER VALUE IN USE STUDIES

There follow additional comments by Dr. Taube which bear significantly on the entire subject of information retrieval systems:

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"The inevitable conclusion of this paper is that use studies have no value as direct guides to the design of information systems, any more than consumer acceptance or rejection is a guide to the value of the Salk vaccine. But this does not mean that use studies may not have other forms of value. A study of the behavior of scientists may help provide information concerning the necessity of sugar coatings on knowledge pills. Consumer resistance to swallowing capsules over a certain size may give valuable clues to the optimum size of information packages. Further, such studies, as in the case of the Salk vaccine, may indicate that consumer education or training is necessary if the full values of scientific information systems is to be made available to society.

"The design of such systems remains a matter of professional competence. All phases of such systems should be studied from the writing of scientific papers through their publication, dissemination, storage, retrieval to their use. The documentalist or information specialist is essentially an engineer. He designs a system in which a favorable ratio is achieved between input costs and payoff in potential use. Part of his design may call for a program to train or retrain users so that they may secure the maximum information potentially available from the system. He will certainly be concerned with patterns of initial dissemination of a primary material in order to determine whether a storage and retrieval system should be planned for a situation of organized or disorganized dissemination. Bernal noted that disorganized primary dissemination means that a storage and retrieval mechanism must be created between the publisher and the user. But this relationship implies that a better organized system of primary dissemination will reduce in some measure the demands made upon storage and retrieval systems. Whether the area of maximum payoff is to be found in organizing primary publication or in planning storage and retrieval systems to handle random initial dissemination is a topic which is now being investigated and which will be the subject of subsequent papers."

CONCLUSION

The entire concept of inventorying and listing current research is so relatively new and the fields and uses so varied that premature judgment cannot be made on actual utility.

The Federal Advisory Committee on Scientific Information should, it is felt, devote considerable attention to the type of problems posed in this preliminary review.

ATTACHMENT A

TABLE LISTING UNCLASSIFIED PUBLICATIONS ISSUED REGULARLY OR IRREGULARLY BY THE FEDERAL AGENCIES THAT INVENTORY CURRENT AND/OR RECENT PAST RESEARCH PROJECTS SUPPORTED IN THE LIFE SCIENCES

Name of agency	*Title of publication*
Atomic Energy Commission	Annual Report of the U.S. Atomic Energy Commission. (A yearly compilation.)
	News Releases Listing Life Science Research Contracts Awarded (and renewed) Each Month.
	Division of Biology and Medicine Summary of Actions Taken on Research Proposals During Month of ———.
Department of Agriculture	(See exhibit 21.)
Department of Commerce: Office of Technical Services.	U.S. Government Research Reports Technical Translations.
Department of Defense:	
Department of the Air Force	European Office, Air Research and Development Command, Activity Report (Quarterly).
	USAF Research and Development Quarterly Review (Air Research and Development Command).
	Annual Index of Research Reported on, USAF School of Aviation Medicine.
	Annual Compendium of DD Form 613, R. & D. Project Cards, USAF School of Aviation Medicine.
	Reports on selected topics in aerospace medicine based on School of Aviation Medicine research; example, "Space Medicine Review."
	Index of Air Force Personnel and Training Research Technical Documentary Reports (by calendar year).
	Index to Air Force Personnel and Training Technical Memorandums (by calendar year).
	United States Air Force—Bioastronautics Research and Development Program, June 15, 1960.
	European Office, Air Research and Development Command, Brussels, Belgium, Bio-Sciences Contract Status. (Monthly.)
	Contract Listing for the Behavioral Sciences Division and the Biological Sciences Division of the Air Force Office of Scientific Research. (Annual on 1 July.)

ATTACHMENT A—Continued

TABLE LISTING UNCLASSIFIED PUBLICATIONS ISSUED REGULARLY OR IRREGULARLY BY THE FEDERAL AGENCIES THAT INVENTORY CURRENT AND/OR RECENT PAST RESEARCH PROJECTS SUPPORTED IN THE LIFE SCIENCES—Continued

Name of agency	*Title of publication*
Department of Defense—Continued	
Department of the Air Force—Con.	Basic Research Résumés, A Survey of Basic Research Activities in the Air Research and Development Command. (An Air Force Research Division publication.)
	Status of Research Proposals. (Published monthly by the Air Force Research Division of Air Research and Development Command.)
	Wright Air Development Division Weekly Activities Report. (Air Research and Development Command.)
Department of the Army	Annual reports of each of the Army medical research laboratories.
	Quarterly Activity Report, European Research Office, Office of the Chief of Research and Development, U.S. Army.
	Annual Research Task Summary—Biological, Medical, Social, and Behavioral Sciences and Operations Research.
	Bound compilations of DD Form 613, R. & D. project cards, by special field.
Department of the Navy	Annual Report of the Surgeon General, Bureau of Medicine and Surgery, U.S. Navy.
	U.S. Navy Medical News Letter (Bureau of Medicine and Surgery, U.S. Navy).
	Annual reports of each of the Navy medical research laboratories.
	Monthly Accession List, Medical Library of the Naval Medical School, National Naval Medical Center.
	Bibliographies of Unclassified Research Reports, Psychological Sciences Division, Office of Naval Research.
	U.S. Navy Electronics Laboratory Annual Technical Progress Report.
	Annual Summaries of Research (reported on during a given calendar year) U.S. Naval Medical Research Laboratory, New London.
Armed Forces Epidemiology Board.	Annual Reports of the 12 Commissions of the Armed Forces Epidemiology Board.
	Army Epidemiology Board, Collected Reprints, volumes 1 through 14, covering period from 1941 through 1956.
Armed Forces Institute of Pathology.	Current Inventory of Research Projects of the Armed Forces Institute of Pathology.
	Annual Report of the Armed Forces Institute of Pathology.
	Annual Collected Papers of the Armed Forces Institute of Pathology.

ATTACHMENT A—Continued

TABLE LISTING UNCLASSIFIED PUBLICATIONS ISSUED REGULARLY OR IRREGULARLY BY THE FEDERAL AGENCIES THAT INVENTORY CURRENT AND/OR RECENT PAST RESEARCH PROJECTS SUPPORTED IN THE LIFE SCIENCES—Continued

Name of agency	*Title of publication*
Department of Health, Education, and Welfare.	Public Health Service Grants and Awards by the National Institutes of Health. By Fiscal Year. (Annual.)
	Research Grants and Awards, U.S. Public Health Service, Announced During —. (Monthly.)
	Scientific Directory and Annual Bibliography, National Institutes of Health. (Calendar year, beginning 1956.)
	Water Supply and Pollution Control. Research Inventory of Active Projects 1958. (Published in 1960; possibly will be annual.)
	Sources of Morbidity Data, from the Clearinghouse on Current Morbidity Statistics Projects. (Annual.)
Department of Interior: Fish and Wildlife Service.	Annual Report of the Director.
	Fishery Bulletin of the Fish and Wildlife Service.
	North American Fauna.
	Research Report.
	Special Scientific Report.
	Regulatory Announcement.
	Statistical Digest.
	Fish and Wildlife Circular.
	Conservation in Action.
	Conservation Bulletin.
	Test Kitchen Series.
	Leaflets and other correspondence aids.
	Fishery Leaflets.
	Wildlife Leaflets.
	Refuge Leaflets.
	Branch correspondence leaflets.
	Posters: Informational posters, presenting information on hunting regulations, public use of refuges, control of harmful species, or other information for prominent display.
	Periodicals:
	Commercial Fisheries Abstracts.
	Commercial Fisheries Review.
	Dingell-Johnson Quarterly.
	Fishery Products Reports.
	Pittman-Robertson Quarterly.
	Progressive Fish Culturist.
	Wildlife Review.
National Aeronautics and Space Administration.	Quarterly Program Report.
National Science Foundation	Federal Grants and Contracts for Unclassified Research in the Life Sciences.
	Report of In-Service Research in Psychology, Psychiatry and Closely Related Areas Conducted by the Federal Government:
	Part I: Listing by Area Within the Field of Psychology.
	Part II: Listing by Agency of the Federal Government.

ATTACHMENT A—Continued

TABLE LISTING UNCLASSIFIED PUBLICATIONS ISSUED REGULARLY OR IRREGULARLY BY THE FEDERAL AGENCIES THAT INVENTORY CURRENT AND/OR RECENT PAST RESEARCH PROJECTS SUPPORTED IN THE LIFE SCIENCES—Continued

Name of agency	*Title of publication*
National Science Foundation—Con.	Semiannual Report of Government-Sponsored Research Projects in Psychology, Psychiatry, and Closely Related Areas: Part I: Listing by Subject. Part II: Listing by Geographical Area.
Veterans' Administration	A Follow-Up Study of War Neuroses.
	A Follow-up Study of World War II Prisoners of War.
	Annual Conference on Cooperative Psychological Research—Summary of Proceedings.
	Annual Report of the Committee on Prosthetic Research and Development.
	Artificial Limbs—A Review of Current Developments.
	Minutes of Working Level Conference on Reading Machines for the Blind.
	Newsletter for Cooperative Research in Psychology.
	Peripheral Nerve Regeneration.
	Quarterly Progress Report of the Veterans' Administration—Armed Forces Study on the Chemotherapy of Tuberculosis.
	R. & E. Newsletter.
	Research in Surgery and Extra-VA Research.
	Research in VA Outpatient Psychiatry.
	Summary of Fifth Technical Session on Reading Machines for the Blind.
	Summary Report of Developments in Veterans' Administration Program on Aids for the Blind.
	Thyroid Scanning.
	Transactions of the Eighteenth Conference on the Chemotherapy of Tuberculosis.
	Transactions of the Fourth Annual Meeting of the VA-Armed Forces Coccidioidomycosis Cooperative Study.
	Transactions of the Fourth Research Conference on Chemotherapy in Psychiatry.
	VA Prospectus Research in Aging.

PUBLICATION BY HEALTH INFORMATION FOUNDATION

Senator HUMPHREY. One of the comparatively few private organizations which issues a publication listing current research projects is the Health Information Foundation.

It has published no less than eight editions of a publication entitled "An Inventory of Social and Economic Research in Health." This publication is, in my personal judgment, invaluable. It has a very fine index and a series of appendixes. Appendix A of that publication

lists alphabetically the sponsors—public and private—of research projects; appendix B similarly lists the organizations actually conducting research; appendix C lists staff members and is called a project personnel index. Finally, there is a very useful subject index.

I feel that this foundation's example might well be studied by Federal agencies.

There follows in the record a response from the foundation as regards this publication, together with the text of the preface from the eighth edition, referred to above:

EXHIBIT 49

LETTER OF OCTOBER 10, 1960, FROM HEALTH INFORMATION FOUNDATION ON ITS PUBLICATION "AN INVENTORY OF SOCIAL AND ECONOMIC RESEARCH IN HEALTH"

HEALTH INFORMATION FOUNDATION,
New York, N.Y., October 10, 1960.

DEAR SENATOR HUMPHREY: Thank you for your letter of September 26 regarding our publication, "An Inventory of Social and Economic Research in Health."

The inventory has been published annually by the Health Information Foundation since 1952 as a service to agencies and individuals engaged in activities related to the social and economic aspects of health. Listings in the inventory are derived from individuals and agencies currently conducting research in this area throughout the United States and Canada. Information is received through mailed questionnaires which we send to such groups as Federal, State, and local health agencies, medical schools, schools of public health, departments of sociology, psychology, economics, voluntary health agencies, insurance agencies, etc.

From personal contact and correspondence we have learned that the inventory has provided a service that was needed in this area. The dissemination of information regarding current, on-going research has helped to avert duplication of effort and has assisted research workers, teachers, administrators, and other action leaders as a research tool and a reference work. As one social psychologist wrote: "I would like you to know how much I appreciate receiving the inventory. Doing research in a rather isolated location has its disadvantages in that I do not hear about other social scientists working on similar problems. Your inventory has remedied this condition to a large extent, and I have developed an active correspondence with several people listed in last year's directory who are working on problems related to my own research."

Many such comments have been received from individuals expressing how valuable the inventory has been to their work. We have also received inquiries as to whether or not there were other comparable publications in other fields such as biochemical and physiological research.

The 1960 edition, which will be off the press in November, will contain over 1,000 listings of research being conducted at the present time, which is some indication of the amount of cooperation we have received from professional workers who are actively engaged in social and economic research in the health field. Demand for copies of the inventory has also increased from year to year with a corresponding increase in interest and cooperation.

In a developing field such as this one, an inventory or index is very useful in order to keep abreast of new projects and find out who is doing what. It may be different in a relatively settled field.

I hope this will answer your query. If you have more questions please let me know.

Yours truly,

ODIN W. ANDERSON, PH. D.,
Research Director.

EXHIBIT 50

PREFACE FROM EIGHTH EDITION OF PUBLICATION, "AN INVENTORY OF SOCIAL AND ECONOMIC RESEARCH IN HEALTH," ISSUED BY HEALTH INFORMATION FOUNDATION

This is the eighth edition of "An Inventory of Social and Economic Research in Health" published by Health Information Foundation. The purpose of this annual listing is to bring together in one volume current research regarding the

social and economic aspects of health being conducted by individuals and agencies in the various disciplines of the health field and the behavioral sciences. It is also hoped that the inventory may stimulate new research, help to avert duplication of effort, and assist in the application of knowledge.

The foundation has published the inventory as a service to the health field since its second year of activity. Sponsored by the drug, pharmaceutical, chemical, and allied industries, the foundation was organized in 1950 to define problems that stand in the way of greater health progress and to explore possible solutions. The inventory is one of several foundation projects intended to bring needed facts and new knowledge to the health field.

Entries are derived for the inventory through questionnaires mailed to organizations and individuals concerned with studies of health levels; health resources—services, facilities, personnel; behavioral and economic aspects of health. Each research agency is asked to define the problem(s) it is studying, to state briefly the methodology employed, a proposed completion date, and other pertinent facts. The research director's name and the names of the principal investigators are requested as are names of financial sponsors and the titles of publications resulting from each study.

As inventory questionnaires are returned to the foundation, projects are classified under the main headings listed in the table of contents. Entries are published as long as research is current or until reports resulting from the study have been published; then they are dropped from the inventory. This edition lists 841 projects, of which 322 are new projects listed for the first time.

George Bugbee is president of Health Information Foundation. Odin W. Anderson, Ph. D., research director of the foundation, is in charge of the inventory project. This edition was compiled by Milvoy S. Seacat, assistant to the research director.

RESEARCH PROJECTS IN PHYSICAL EDUCATION

Senator HUMPHREY. Still another type of published inventory is a helpful booklet entitled "Completed Research in Health, Physical Education, Recreation."

Volume 1, the 1959 edition, covers research completed in 1958. This is a 60-page booklet, consisting of three parts. Part I is an index. Part II relates to published research in the form of a bibliography of research, covering articles published in 53 periodicals. Finally, of deepest interest within our present context is part III, a list of unpublished—I emphasize the word "unpublished"—masters' and doctors' theses.

This publication is issued under the auspices of the Research Council of the American Association for Health, Physical Education, and Recreation, a department of the National Education Association.

ANOTHER ILLUSTRATION OF A PREPUBLICATION FILE

We have explored the question, "Does any other field in the life sciences offer evidence of a felt need for indexing current research projects?"

One answer to the question is found in the following brief bulletin in the magazine Science, as regards plant taxonomy research.

EXHIBIT 51

ARTICLE ON A CURRENT FILE ON PLANT TAXONOMY RESEARCH

[From Science, Oct. 7, 1960]

PLANT TAXONOMY RESEARCH

Raymond C. Jackson, of the department of botany, University of Kansas, Lawrence, is establishing a card file on all research problems in plant taxonomy under investigation in North America. Botanists involved in taxonomy work are earnestly requested to support this project, which is under the sponsorship of the

American Society of Plant Taxonomists, by sending Jackson information on current research. Such information should include a brief description of each project, the names of those conducting the investigations, and the sources of research support. The object of the file is to eliminate duplication of taxonomic effort and to foster cooperation between those working on a common problem from different approaches.

OTHER UTILIZATION OF UNPUBLISHED RESEARCH

As two final points on this matter of prepublication information, we might note that:

(1) The American Chemical Society (which is deservedly famous as a pace-setter among the professional organizations in the world) has long been interested in utilization of unpublished materials. Its outstanding compendia, "Directory of Graduate Research," prepared by its committee on professional training, list "Faculties, Publications, and Doctoral Theses in Departments or Divisions of Chemistry, Biochemistry, and Chemical Engineering at United States Universities." For example, the introduction to the volume notes:

For each department or division the degrees offered are indicated, together with a statement of fields in which doctoral degrees are granted. Following this, the academic staff is listed alphabetically, with brief biographical information, a statement of the field of major research interest, and a specification of the subjects of current research interest for each individual.

(2) Finally, it should be noted that the Office of Science Information Service, National Science Foundation, has as one of its definite programs, increasing utilization of what it terms "URI"—i.e., improving the accessibility of Unpublished Research Information. In its ninth annual report (H. Doc. No. 300, 86th Cong., 2d sess., p. 100) NSF notes that the major sources of URI are "research reports and memorandums of Government and private institutions, theses, dissertations, and papers resulting from scientific conferences."

The same report cites NSF's work in connection with BSIE and SIE as an illustration of its efforts toward increased utilization of "URI."

GENERAL VIEWS OF NATIONAL SCIENCE FOUNDATION

Senator HUMPHREY. I would not want the earlier brief references to the National Science Foundation's vital role to comprise the only references in this transcript.

There will be printed in the transcript, therefore, at this point, a followup letter which we will ask of Dr. Wilson as regards advanced, substantive interagency coordination, as spearheaded by the Foundation.

By advanced, substantive coordination, I mean not only coordination of information but such activities as joint financing of actual research.

EXHIBIT 52

LETTER FROM NATIONAL SCIENCE FOUNDATION ON INTERAGENCY COORDINATION

NATIONAL SCIENCE FOUNDATION,
Washington, D.C., August 26, 1960.

MY DEAR SENATOR HUMPHREY: This is in response to your letter of August 15, 1960, in which you ask for further comments on the subject of how the National Science Foundation views the problem of interagency coordination in biomedical research. As you have suggested in your letter, our comments will be relatively brief inasmuch as on pages 51–54 of the Committee Print No. 7,

"The National Science Foundation and the Life Sciences," there is covered in detail a discussion of the relationship of the Foundation to other Government agencies, including examples wherein the Foundation is represented ex officio on councils of the National Institutes of Health and on the Board of Regents of the National Library of Medicine.

A point which was not covered very adequately in the recent subcommittee hearings and which is mentioned specifically in paragraph 3 of the memorandum enclosed with your letter has to do with examples of cooperation with other agencies in research and in other ways. We will mention a few such examples in order to indicate that such instances do exist in a good many cases.

An outstanding example of cooperative support between the Foundation, the National Institutes of Health, and a private agency (the Rockefeller Foundation) is illustrated by the recently dedicated research laboratory at the Marine Biological Laboratory, Woods Hole, Mass. The laboratory was funded approximately 50 percent by the Rockefeller Foundation with the other half of the costs being shared equally by the National Institutes of Health and the Foundation. Joint planning for the funding of this structure was conceived of at its initiation and all three agencies knew of the other's plans and actions from the beginning of the project. Another such example is the high-altitude laboratory of the University of California. This laboratory, which is concerned with studies of the effect of high altitudes on biological systems, has been jointly funded with reference to physical facilities and with reference to its ongoing research program by the Office of Naval Research and by the Foundation. A third facility grant, that to the Communications Research Institute, located at St. Thomas Island, is still another example of joint funding by the Office of Naval Research and the Foundation. Among other things, this laboratory is interested in the communication mechanism utilized by porpoises.

Two instances of current joint discussions which have not yet developed to the point of grants also come to mind. The first of these two is at the level of program planning rather than project planning. In February 1960, the National Institutes of Health and the Foundation held an ad hoc meeting of consultants and staff representatives to discuss electronic computers and their use in life science research. The immediate problem was the extent to which such computers are needed in life science research, the extent to which funds are available from general computer support programs, and the action needed to meet any demands which cannot be met by general computer support programs. To illustrate the degree of cooperation in this planning session, the meeting was held at the National Institutes of Health, chaired by the Associate Director for Research of the National Science Foundation and participated in by staff and consultants from both agencies. The result of the meeting was to establish a joint committee on computers on life sciences research under the auspices of the National Research Council, with members on the committee from both agencies, the National Research Council, and the scientific community. Thus, any development in the support of computers specifically related to life science research and training will be common knowledge to the life science community and to the agencies most concerned with such support.

Another example of current collaborative planning relates to a very large proposal from one of our leading universities for the establishment of a communications laboratory. Discussions have been held between university representatives and representatives of the Office of Naval Research, National Science Foundation, National Institutes of Health, and the Air Force. The present stage of development in this program is that an informal proposal is currently under review in the several agencies, subject to joint discussion in the very near future.

In the area of conferences and congresses, there are many examples of collaborative support. For example, the International Congress of Nutrition which is to be held in Washington in a few weeks is being jointly supported by the National Institutes of Health, the Department of Agriculture, and the Foundation. The Pacific Science Congress which is to be held next year in Honolulu will also be jointly supported by NIH, the Foundation, and by several other Government agencies. The Atomic Energy Commission, the Department of Agriculture, and the Foundation have collaborated on a symposium on radioisotopes in the biosphere as well as on conferences sponsored under the auspices of the National Research Council on subjects of interest to all three agencies.

Specific instances of joint research support may also be cited although the more frequent pattern is for a given investigator to have grants from different agencies which cover different aspects of his total laboratory program. However, joint support of the same enterprise actually is not uncommon. For

example, the research of Dr. Carl Pfaffman at Brown University in sensory physiology has been jointly supported by the Office of Naval Research and by the Foundation for the past several years. Similarly, the research program of Dr. S. S. Stevens at the Bioacoustics Laboratory of Harvard University has been jointly supported by the Office of Naval Research and the Foundation. Several projects in the general area of systematic biology enjoy joint support between the Smithsonian Institution and the Foundation. The typical pattern here is for the Foundation to support travel or other field costs of the principal investigator, with the Smithsonian supporting his salary and that of his professional assistant. Still other examples of joint research support between the Foundation and the National Institutes of Health would include the work of Dr. Frederick M. Richards at Yale University who is working on the molecular structure of ribonucleause; the research of Dr. David Shemin at Columbia University who is working on the biosynthesis of porphyrins; the work of Dr. Jerome Gross at the Massachusetts General Hospital who is working on the nature of collagen molecules in normal and abnormal tissues; and the work of Drs. Stephen Kuby and Henry Lardy at the University of Wisconsin who are working on the action of enzymes involved in phosphate transfer. In all such cases, both the National Institutes of Health and the Foundation are aware of the joint nature of the proposals being submitted and of the action being taken by the other agency. In many instances the joint support (particularly with the agencies of the Department of Defense) is the result of the fact that a portion of the project may have applied implications which are of direct interest to the military, with the other portion being quite fundamental in nature.

In your letter you asked specifically for comments regarding our observations on the relationship between the Foundation's basic research program and that of the Department of Agriculture. The Foundation has been interested in the support of basic research in agriculture as well as in other life science areas since its inception. About 4 years ago the staff of the Biological and Medical Sciences Division made a special effort to visit agricultural experiment stations throughout the country to become acquainted with the research programs of the stations. Simultaneously, an exchange of information was initiated between the staff and representatives of the Agricultural Research Service, both for the purpose of informing ourselves as to the scope of ARS activities and as to its policies for research support. As part of this exchange of information effort, the Assistant Director for Biological and Medical Sciences has regularly met with the directors of experiment stations at the time of their annual meeting in Washington. On various occasions, he has also responded to invitations to talk to the staffs of schools of agriculture and agricultural experiment stations. As a consequence of these activities the Foundation receives proposals for the support of basic research at experiment stations and responds to these on the same basis as it does to other proposals for research support. Information on research grants in fields related to agricultural research is available through project listings (which are available to the staff of ARS) or through the BSIE (which information is available to the Agricultural Research Service even though they may not be members of BSIE).

In summary, I would say that the working relationships between the Foundation and the Department of Agriculture are quite good, with both agencies being informed of the activities and policies of the other.

Sincerely yours,

JOHN T. WILSON,
Assistant Director for Biological and Medical Sciences.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Senator HUMPHREY. I am going to move along now to one of your other associates here, Dr. Randt, of NASA. I believe that the National Aeronautics and Space Administration has certain activities in the field of medical research.

There was a hearing on space medicine research conducted in June 1960 by a House space subcommittee. Congressman Moeller, of Ohio, inquired of you as to the extent to which NASA life science programs are drawing upon the related work of the National Institutes of Health and of other Federal agencies.

I would like to know specifically how this is accomplished; which of the seven institutes has or have been contacted; and what you found as to the extent to which NIH can contribute to space medicine.

Dr. RANDT. Yes, Senator. The Office of Life Science Programs was established as of March 1, 1960, so we have attained only informal liaison with the NIH.

Dr. Shannon was consulted about the plans for the establishment of this Office as long as a year ago. Dr. Seymour S. Kety, of NIH, chaired the Bio-Science Advisory Committee that provided the guideline for the establishment of this Office. Our coordination with NIH has not attained more than these informal types of liaison to date.

NASA–DOD COORDINATION

Senator HUMPHREY. Will you indicate how the NASA could coordinate with the Department of Defense, since there is as yet no central means, no central publication or group of publications which indexes all current Department of Defense research in the Air Force, Army, Navy, and the life sciences? I gather there is some relationship between what you are doing and what the Air Force, in particular, is doing.

Dr. RANDT. Yes, sir. The life sciences attained formal representation in the NASA on March 1, and on that day we had our first meeting with representatives of the Department of Defense in this area under the auspices of Dr. York's office.

This activity was continued on April 26, on June 23, and our next meeting is scheduled for September 8. In this group are represented the Department of Defense, Army, Navy and Air, and representatives of the coordinating committees of the Department of Defense in biology, medicine, and psychology. So this is a conference group where a more formal type of liaison has been established.

Senator HUMPHREY. Does that still answer the problem, Doctor, does it answer the problem of coordination or of cooperation when there is no central means, a central publication or group of publications which indexes all of the research work in the Air Force, Army, and Navy?

Isn't it possible that NASA might be venturing off into the same kind of activity as others and that the field may be well occupied by the Department of the Air Force, for example?

Dr. RANDT. This particular group is directed toward the intramural efforts in the Department of Defense and the military service laboratories.

As of July 1 we began our participation with the BSIE, and their intramural programs are recorded there.

Senator HUMPHREY. DOD's extramural?

Dr. RANDT. Yes, sir.

Senator HUMPHREY. And your intramural projects are now being registered with BSIE?

Dr. RANDT. Yes, sir.

Senator HUMPHREY. So you feel now that the problem of coordination insofar as the indexing and the availability of information on current research, particularly in the extramural activities, is well in hand, well under control?

Dr. RANDT. Yes, sir.

Senator HUMPHREY. Is that your observation?

Dr. RANDT. This is.

Senator HUMPHREY. Do you have any other point that you would like to raise on this, Dr. Randt, relating to the coordination of research activities in the life sciences?

Dr. RANDT. Inasmuch as our office has been so recently established, I am particularly appreciative of this opportunity to gain information about the problems in this area.

FUTURE NASA TRENDS

Senator HUMPHREY. Aren't you apt to be having a rather larger program in the days ahead because of the great emphasis upon space exploration?

Dr. RANDT. I believe that if the life sciences are to be appropriately represented in the space effort, this will be true.

Senator HUMPHREY. Will you be an operating agency or will you be a contracting agency?

Dr. RANDT. I would hope that we would be both, and I do not believe that this effort can be satisfactorily represented on any other basis.

Senator HUMPHREY. You will have to work closely, will you not, with NIH, for example?

Dr. RANDT. We would intend to do so.

Senator HUMPHREY. And with the many projects which the Department of Defense would have, because of the military problems involved here?

Dr. RANDT. Yes, sir, and the Atomic Energy Commission and the Federal Aviation Agency.

Senator HUMPHREY. Space medicine is always a fascinating subject for a layman. Has there ever been to your knowledge a general meeting called relating to the emphasis that we ought to place in space medicine development and research, or the trends in space medicine?

Have you participated in one of those meetings at which all of these many fine distinguished research directors have been present?

Dr. RANDT. No, sir, I have not.

Senator HUMPHREY. This is the problem we are again getting back to, Dr. Shannon.

CONTRIBUTIONS BY NATIONAL ACADEMY

Dr. SHANNON. Senator Humphrey, I think that Dr. Randt may have—I got a different thrust from your question than he did.

In the field of biomedical aspects of space, there have been a whole series of meetings, of individuals from a variety of agencies that have interests. I know we participated through making available Dr. Livingston. These meetings were all under the auspices of the National Academy of Sciences and National Research Council.

I think Dr. Cannan might want to talk on this, because this went back many, many months prior to the establishment of a formal organization.

So I think we all have had an opportunity to indicate the impact that our programs might have upon the field, the areas that we might undertake exploration in, and this I might say was at the instigation

of the Administrator of the Space Agency and at the instigation of some of the interested people in the National Academy of Sciences, who wanted to prepare the way for the development of the program that had to be broadly significant.

I would agree with Dr. Randt that this is going to be a broadly significant program that is going to involve a substantial direct operation as well as a very broad, I would hope, grant operation rather than contract operation.

But I would raise a question that there has not been this type of meeting of the individuals that are in this room.

Senator HUMPHREY. That was the question. I think he answered my question properly in light of his information.

CONFERENCES AT POLICY LEVEL

I have no doubt but what you have had all types of conferences and meetings on the subject of space medicine with competent people in this area. But I was wondering whether or not Dr. Shannon had ever called a conference or whether any of you other distinguished scientists or directors here had called a major policy conference under a shield as big as the Federal Council on Science and Technology, for example.

This is the point that we are getting at, because there is a great deal of difference in a meeting of the administrative assistants of the U.S. Senators, gentlemen, than there is of a meeting of the Senators. I don't say one will get more work done than the other, I don't want to make any evaluation of that, but I can assure you there is a little difference. That is the point.

Maybe the administrative assistants will get the job done better than if we have a meeting, but from the point of view of the Senate, in case there is a vote cast, the administrative assistant is denied that rare privilege, and we have to cast the vote. That is the point of programing that I am getting at. Somewhere along the line, the programing has to be done by the people with the title.

At this point in the record there will appear (*a*) the text of a letter which I plan to send to the National Aeronautics and Space Administration requesting certain additional information and (*b*) the text of NASA's reply.

EXHIBIT 53

LETTER OF AUGUST 16, 1960, TO NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ON COORDINATION OF SPACE MEDICINE RESEARCH

AUGUST 16, 1960.

Dr. CLARK T. RANDT,
Director, Office of Life Sciences, National Aeronautics and Space Administration, Washington, D.C.

DEAR DR. RANDT: Thank you for your helpful comments at last Thursday's subcommittee hearing.

Enclosed are (*a*) the transcript for editing and (*b*) a memorandum, confirming my comments at the conclusion of the hearing, requesting an additional statement on NASA's part as regards interagency coordination.

In this connection, I have noted the detailed analysis on this coordination theme already made on NASA life sciences programs by the staff of the Senate Committee on Aeronautical and Space Sciences in its report of July 15, 1960.

I would not want NASA needlessly to repeat to our particular subcommittee factual information already covered by the Senate Space Committee.

Please refer, therefore, in the forthcoming NASA memorandum, to material which will be supplemental to rather than duplicative of the aforementioned July 15, 1960, report, insofar as possible.

Kindest wishes.

Sincerely,

HUBERT H. HUMPHREY,
Subcommittee Chairman.

EXHIBIT 54

LETTER OF SEPTEMBER 16, 1960, FROM NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ON COORDINATION OF SPACE MEDICINE RESEARCH

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION,
Washington, D.C., September 16, 1960.

DEAR SENATOR HUMPHREY: In reply to your request of August 16, 1960, for additional information regarding the NASA Office of Life Science Programs coordination of biomedical research activities with other Federal agencies, I wish to submit the following information in accordance with your memorandum dated August 1, 1960, in addition to the information on this subject incorporated in the staff report of the Senate Aeronautical and Space Sciences Committee dated July 15, 1960.

The NASA–DOD Aeronautics and Astronautics Coordinating Board has been established recently, replacing the Space Council and the Civilian-Military Liaison Committee, to review planning, avoid duplication, coordinate activities of common interest, identify problems requiring solution, and to insure a steady exchange of information. The group is composed of officials actively engaged in the management of space programs of both the Department of Defense and the National Aeronautics and Space Administration, with Dr. Herbert F. York, Director of Defense Research and Engineering, and Dr. Hugh L. Dryden, Deputy Administrator of NASA, as cochairmen. It will have working panels to coordinate specific phases of the space programs of both agencies, including the life sciences.

Other areas of overlapping life sciences interest with NASA include the National Science Foundation Division of Biological and Medical Sciences, National Institutes of Health, U.S. Public Health Service, the AEC Division of Biology and Medicine, and the FAA Bureau of Aviation Medicine. These relationships have been described previously in the document mentioned above, as has the NASA Office of Life Science Programs participation in the BioScience Information Exchange.

In June 1960, the NASA Office of Life Science Programs supported a series of experiments designed to study the effects of cosmic rays on the brains and gonads of mice at altitudes above 130,000 feet in conjunction with the Department of the Air Force balloon flights in northern Minnesota. Two research projects concerning "The effects of rotation on humans" and "Life under exotic conditions" are now being supported by NASA funds at the U.S. Naval School of Aviation Medicine. A number of proposals from the Army, Navy, and Air Force biomedical laboratories are now under active consideration for support by the NASA Office of Life Science Programs.

The Office of Life Science Programs of NASA has representatives of the Army, Navy, Air Force, and AEC on its Advisory Committee on Flight Medicine and Biology, and two representatives of the National Institutes of Health on its Space Medical and Behavioral Sciences Advisory Committee.

Col. Charles H. Roadman, MC, USAF, is special assistant to the Director of the NASA Office of Life Science Programs on detached service. In this capacity, he participates in the planning, supervision, and coordination of all phases of the programs of this office on a full-time basis.

I trust that this account will satisfy the needs of your committee. I shall be happy to supply any additional information deemed necessary.

Sincerely yours,

CLARK T. RANDT, M.D.,
Director, Office of Life Science Programs.

NATIONAL ACADEMY OF SCIENCES AND NATIONAL RESEARCH COUNCIL

Senator HUMPHREY. Moving along to Dr. Cannan, we will come back, if we need to, to you, Dr. Randt. Will you comment on the problem of coordination, because this surely is in part your problem, as viewed from the standpoint of the National Academy of Sciences and National Research Council, and what it might do in the future in cooperation with the agencies.

Dr. CANNAN. Thank you, Senator.

As the proceedings of this hearing have unfolded I have found it a very relaxing thought that I am not responsible for the management of a program of research that is supported by Federal funds. There are advantages in serving an institution, the Academy-Research Council, that advises but does not operate.

Today, we are concerned with the coordination of medical research in the national interest. Dr. Shannon has outlined the variety of instruments that may be used by an administrator to assist him in making decisions with respect to the design and management of a program comprising many kinds of projects. Discussion has subsequently centered around the type of instrument so ably conducted by BSIE. This, we are all agreed, provides information of the greatest service to the administrator but is of limited value to the investigator. Systems of indexing, coding, and tabulating information contained in project outlines can answer the questions "who" and "where." Indexers, however, cannot be expected to read the minds of the project directors or the minds of other investigators who may be seeking information contributory to ideas of their own. Consequently these kinds of tabulations can convey little of the how and the why of research in progress. It seems to me this point has been adequately made today.

VALUE OF CONFERENCES

To sense and evaluate the flux of ideas in science, the well-tested instrument is the advice of groups of experts gathered together as committees, workshops, conferences, and symposia. These may be regional, national, or international. This is the type of service with which I am most familiar because it is the one historically associated with the National Research Council.

Such gatherings of experts are not, in general, decisionmaking bodies. Yet my experience persuades me that they do exert profound and enlightened influence on decisionmaking. If the executives of all agencies with overlapping interests actively participate in the deliberations of such groups—and this, in my judgment, is where the power of the instrument lies—then a pooling of plans and ideas occurs, and much constructive interagency coordination results.

DEVELOPMENT OF GERM-FREE RESEARCH

May I cite two examples from my own experience? Both situations have been referred to this morning.

The Office of Naval Research was the pioneer agency in recognizing the promise of research on germ-free animals and gave it generous

support. As the interest in and the demands of the program expanded, ONR realized the need to develop plans for the future on a broader base than a single agency and turned to the National Research Council to evaluate the field and explore the interests of other agencies. Three conferences were held and were attended by scientific experts and by the administrative officers of all interested funding agencies. The potentialities, needs, and limitations of this new tool for medical research were explored in depth and a clear estimate of the opportunity emerged. No decisions were made on the spot, but shortly thereafter plans developed for a reorientation of the program at Notre Dame and for the establishment of facilities at Walter Reed and, later, at NIH. This was constructive coordination based on intensive inquiry and deliberate judgment.

DEVELOPMENT OF SPACE MEDICINE

My second example, Senator Humphrey, is the question you have discussed with Dr. Randt—the coordination of research in the life sciences as a component of the national effort in the exploration of space. In the presputnik era, interest in bioastronautics was centered in the Armed Forces. Recognizing the need for a broad civilian as well as military base, if a sound and adequate program was to be developed, the three Armed Forces combined to invite the National Research Council to establish an Armed Forces-NRC Committee on Bioastronautics. This was done and a quite vocal forum for exchange of ideas, information, and plans was quickly developed. To this forum came executives and scientists from the military establishments, NASA, NIH, NSF, and other agencies together with an enthusiastic group of academic scientists. This committee and its panels have made few formal recommendations, but, I believe, its deliberations have been formative in the developing programs of NASA and of the Armed Forces.

Other examples may be cited. The National Research Council, in the execution of its responsibility as adviser on research contributory to the national blood program, has for many years provided a place where officers of DOD, OCDM, PHS, and the National Red Cross can meet with civilian scientists to develop integrated research efforts.

Two other current activities of concern to several agencies are the Survey of the Uses of Electronic Computers in Biology and Medicine and the Survey of the Needs and Responsibilities of the United States in Tropical Medicine. The reports on these surveys, in due course, may be expected to contribute to the integration of the national effort in the fields that they cover.

LIMITATIONS OF MECHANICAL METHODS

My argument, I suspect, is that mechanical aids for the collation and dissemination of scientific ideas can support but they cannot yet replace the more deliberate person-to-person interaction by which raw ideas mature to concepts and concepts to working hypotheses. It is the latter that form the stimulus to fruitful research. The rate at which an idea matures is dependent on the contemporary climate of opinion in science. It requires a receptive climate for a favorable consensus

to develop. Without the latter an administrator is unlikely to have the vision or the courage to recognize the power of a new idea.

So, the deliberative body has come to be recognized as the most powerful instrument for assistance in decisionmaking by executives of programs of research.

DRAWBACK OF INTERAGENCY COMMITTEES

One can, however, have too much of a good thing. We are, today, constructing such a hierarchy of advisory bodies within and without Government that we are already taxing our resources. A limited number of experts in a field find themselves recruited to several committees in different agencies having surveillance over the same territory. If we continue to increase the amount of time we expect our best scientists to spend away from their laboratories, we may arrive at the point at which our best minds are spending all of their time deciding which are the less mundane of the projects proposed by our second-rate minds.

This is a real problem. In our efforts to minimize duplication of effort in research we might do well to begin by seeking to reduce duplication of the efforts of our advisers and to increase the coordination of advisory services.

Senator HUMPHREY. Before you brought this up, Doctor, there was running through my mind a thought about the problem of so many advisory groups, councils, and commissions.

There is, of course, under Executive order, the Federal Council of Science and Technology; there is the President's Science Advisory Committee. Then, of course, there is the National Academy of Sciences–National Research Council.

Some of these are strictly public and some of them are quasi-public, but for the layman or even those of us that try to interest ourselves in terms of our legislative responsibilities in these matters, this is a maze, a labyrinth of agencies and commissions that is hard to follow.

Then, when you get down to these interagency groups, it even gets more complicated. I have strong feeling on the problem that was referred to here this morning—the time problem confronting the scientists. When we were overseas talking with scientists in Western Europe, particularly doctors that were receiving grants under the Public Health Service, they would frequently say to us, "Well, there is too much paperwork." But when they were receiving a grant from say, the Rockefeller Foundation, they found there was much less paperwork.

Now, if you add on top of all of this paperwork an extreme application of the other things that we are talking about this morning, plus the host of advisory groups that you have to have, you may run the risk of taking what I consider to be the brains—the technical know-how in the field—in the discipline that the scientist has given his life to, and setting that aside, and he becomes largely a reporter.

He becomes a consultant and an arbitrator, rather than a really truly working scientist either in the leadership area or in the laboratory. I wondered how you gentlemen have time to do anything else but consult. So, I am well aware of the need for care and balance in applying the concept of coordination.

What I am driving at, of course, is the need for commonsense in dividing up the working day so as not to overdo coordination, and not to ignore it either.

Dr. CANNAN. There is at this moment, Senator, a meeting of the Academy on the space bioscience problem—an attempt to contrive the most economical but most effective system of advisory groups for these interagency interests. When our service here is complete, I think Dr. Randt and I will be running there.

VETERANS' ADMINISTRATION RESEARCH

Senator HUMPHREY. Thank you very much, Dr. Cannan. I want now just to turn to the Veterans' Administration, represented here by Dr. Musser.

Dr. MUSSER. Yes, sir.

Senator HUMPHREY. Just to bring you into the general discussion, because you do so much in this field of research, I believe that we have about 1,500 doctors in the research in 128 VA hospitals, approximately. The problem of keeping these doctors informed on current research must be one of rather significant proportions.

I had brought to our attention a pertinent House report. There were two volumes, entitled "Medical Research in the Veterans' Administration," prepared by VA's Department of Medicine and Surgery and published by the House Committee on Veterans' Affairs in June of this year.

On page 1 of that House Committee Print 218 it was indicated that 1,522 full- and part-time physicians in the Veterans' Administration were participating in research programs in 128 hospitals; in addition, over 500 biochemists, chemists, bacteriologists, physicists, and others contributed to the program.

HOW DOES INVESTIGATOR KEEP INFORMED?

The question, therefore, which I would like to ask is: How do these hundreds of individuals functioning as principal investigators keep currently informed as to up-to-the-minute Federal research being performed in other Federal agencies?

You will note that my question is not "How do they keep up with their own field, based upon already published information in professional journals?" but rather, "How do they keep informed on the hundreds of projects pertaining to their field which are not published, and which are right now being conducted in other Federal bureaus, divisions, et cetera?"

Dr. MUSSER. Senator, I am not so sure that all of them keep themselves well informed. This gets into the area that Dr. Shannon was talking about.

The extent to which an individual investigator is informed is directly a reflection of the energy that he exerts in informing himself. We try to make available to him our own publications, to which you referred, that list our own research activities.

He also has access to other governmental agency reports regarding the research activities that they have. Many of our hospitals work in close affiliation with medical schools, and thus our investigators have access to medical school libraries and the various departments in

those medical schools from which an additional volume of knowledge and information regarding research activities, in general, might be obtained.

However, none of our people has access to a single cataloging, if you will, of current Federally supported research activities. I must say that I am not sure how many of them would read it if they did have it available, because, by and large, their habits don't follow these lines. I think some of the things Dr. Shannon mentioned would support this.

SUMMARIES PREPARED BY BSIE

Senator HUMPHREY. Doctor, there was a time that the Bio-Sciences Information Exchange furnished summaries to all Veterans' Administration hospitals in certain fields, such as clinical psychology, psychiatry, and neurology.

Now, these have been discontinued, isn't that right, Dr. Deignan? I might ask why were they discontinued and were these summaries at all useful.

Dr. MUSSER. They were not widely used, and furthermore, we subsequently changed our system, in that at the present time BSIE has an abstract of every research project that is currently in process in the Veterans' Administration.

Our people have been invited to request of BSIE copies of all abstracts of research in progress relating to a certain category. Thus, this service is available to all of these 1,500, and more, scientists, if they choose to use it.

PUBLICIZING OF BSIE'S SERVICE

One of the things that we have found is that for various reasons the services which BSIE is equipped to render have not been as widely publicized as they might be. We are in the process now of acquainting our physicians over the country with the availability of information which BSIE has, and we think that increasingly our people will turn to BSIE to get abstracts of research currently in process.

As I have gotten around into various medical schools and our own hospitals, I have been rather surprised how few investigators know that these resources are available in BSIE, and I think that a lot of the problem is in advertising them.

FAMILIARITY WITH REFERENCE SERVICE

Senator HUMPHREY. And it is a problem of the educational process itself at the technical training level.

I remember, when I went to pharmacy school, the old professor used to tell me, "I don't expect you to remember, really, much of anything that you are being taught except where to look for it when you need it."

I think that is the main job that the person has, to know where do you turn to get information. This is our problem in the Senate every day. People are coming to us every day, if not by person, by letter, with the most difficult and complicated or sometimes trivial problems.

The question is: Who do you notify, who do you look up to find the answer, what agency do you go to? This is one of the reasons, I guess, they need Congressmen and Senators.

We are supposed to know what door to walk into to find somebody behind the door that has the answers.

BSIE MAILINGS OF REPORTS TO GOVERNMENT AGENCIES

On this matter of BSIE print-outs of information, I shall ask that there appear here an excerpt of a reply from BSIE, prepared at our request, listing its routine mailings to Government agencies—both those now going out and those which formerly went out—on particular subjects.

EXHIBIT 55

EXCERPT FROM LETTER OF AUGUST 5, 1960, FROM BIO-SCIENCES INFORMATION EXCHANGE ON ROUTINE MAILINGS TO GOVERNMENT AGENCIES

A. ACTIVE

1. Nursing, Division of Nursing, PHS.
2. Nursing, Division of Research Grants, NIH.
3. Psychopharmacology, National Institute of Mental Health.
4. Psychopharmacology, VA central office.
5. Environmental sanitation, Division of Sanitary Engineering Services, PHS.
6. Occupational health, Division of Sanitary Engineering Services, PHS.
7. Research on children, Children's Bureau.
8. Mental health in education, Community Service Branch, NIMH.
9. Ageing, Center for Ageing Research, NIH.
10. Morbidity, Clearinghouse of Morbidity Statistics, PHS.

B. DISCONTINUED

1. Experimental embryology, Division of Research Grants, NIH.
2. Developmental anatomy, Division of Research Grants, NIH.
3. Erythroblastosis, Division of Research Grants, NIH.
4. Atherosclerosis, fat and cholesterol metabolism, National Heart Institute, NIH.
5. Social sciences, Social Security Administration.
6. Clinical psychology, All VA hospitals with pertinent services.
7. Psychiatry, All VA hospitals with pertinent services.
8. Neurology, All VA hospitals with pertinent services.

VETERANS' ADMINISTRATION SUBJECT-TYPE REQUESTS

Senator HUMPHREY. I notice from our study that you have a total of 6,371 projects. The dollar volume is $14,995,000, and you have only made subject-requests from BSIE on 35.

Dr. MUSSER. I would venture to say most of those requests, Senator, were made from our own service in trying to compile data pertinent to the development of new programs.

I would suspect that very few of those requests at the time when those figures were compiled, which was fiscal year 1959, emanated from our field investigators.

Senator HUMPHREY. In other words, those requests were made by the central office as you programed further research efforts?

Dr. MUSSER. Yes, sir.

If we are considering a new study, we immediately would turn to BSIE and other sources of information to familiarize ourselves with the other activities that are currently going on.

Senator HUMPHREY. Do you register all of your projects with the BSIE?

Dr. MUSSER. Yes, sir.

Senator HUMPHREY. That is very helpful. I imagine the university medical schools use this information; isn't that right, Dr. Deignan?

Dr. DEIGNAN. Yes, sir.

Dr. MUSSER. I feel that as the resources of BSIE are more widely known, increasing use of them will be made.

ADDITIONAL CORRESPONDENCE FROM VETERANS' ADMINISTRATION

The Veterans' Administration has provided much helpful data to us. We are deeply interested, of course, in its overall work.

We've looked into veterans' medical problems from here to the Institute of Brain Damage in Helsinki, Finland (see pt. I, Committee Hearings, July 1959, p. 268).

We believe that our Veterans' Administration has contributed tremendously in serving the well-being of sick and disabled veterans—in a way which all the world should note.

There will follow a series of letters with the Veterans' Administration.

EXHIBIT 56

LETTER OF JULY 12, 1960, TO VETERANS' ADMINISTRATION ON USAGE OF INFORMATION ON OTHER AGENCIES' RESEARCH PROGRAMS

JULY 12, 1960.

Hon. SUMNER G. WHITTIER,
Administrator, Veterans' Administration,
Washington, D.C.
(Attention of Dr. William Middleton).

DEAR MR. WHITTIER: I appreciate the prompt and helpful cooperation which has been afforded to our subcommittee by the Veterans' Administration in responding to the numerous inquiries which we have addressed to yourself and Dr. Middleton.

I am writing today on a matter which I have raised in somewhat comparable form with the National Institutes of Health and other Federal agencies engaged in biomedical research.

It concerns the question of how the respective Federal agencies avoid overlapping, duplication, or, more likely, "overinvestment" or "underinvestment" in particular subjects for research projects as compared with what other Federal agencies and private institutions are researching.

First, let me say that I am well aware that the "screening" machinery in each of the Federal agencies, e.g., the study panels and granting councils, or their various equivalents, consist of many of the most knowledgeable experts in medical science.

I am aware, too, that scientists in and out of the Federal Government maintain touch with one another and with the "state of the art" through visits, correspondence, reading of professional journals, attending seminars, conferences, etc.

At the same time, the literature of medical science is full of reports that it is difficult to keep up with the state of the art, even so far as reading the professional literature in important fields is concerned, because of the thousands of articles appearing all over the world. In any event, to keep up with professional literature is a different matter from keeping up with prepublished knowledge, i.e., with research projects which may be in process for years before they ever see publication form, if ever.

Now, specifically, according to information furnished to me by the Bio-Sciences Information Exchange at my request, in mid-1960 VA had 10,403 active projects registered with the Exchange.

Yet, during the calendar year 1959, the Veterans' Administration, as such, (aside from an apparently modest volume of requests from its individual scientists) addressed only 35 subject-type requests to BSIE. Similarly, NIH with

9,976 extramural projects registered, addressed only 307 subject inquiries. National Science Foundation, with 2,115 registered projects, addressed 5 such inquiries.

In all frankness, this usage for subject requests tentatively appears low in relation to the complexity of some 30,000 projects registered with the Exchange, under literally thousands of index headings.

And, so, specific questions which I would like to pose are as follows:

(1) Does VA regard this volume of usage in subject-type requests as adequate in order to avoid the dangers I have mentioned?

Or does VA perhaps regard this particular usage statistic not as significantly as the subcommittee does?

(2) What type of analyses by subject as to VA's own current projects are regularly or irregularly available to individuals in the respective VA hospitals, and/or elsewhere, who may screen or otherwise act on proposed new VA research projects?

Similarly, what types of analyses by subject are available to such individuals as regards the nature of NIH, DOD, and of other agencies' current research projects, in addition to private organizations' projects?

(3) Likewise, what types of analyses does VA send regularly or irregularly as to its subject-matter commitment to other agencies' screening echelons so as to assist them?

(4) Does VA actually use throughout its hospital system the analyses of "Amounts Awarded Multiple Subject Categories," as prepared by BSIE?

(5) Does VA feel that the absence of statistics on intramural research commitments (VA's, NIH's, and others) lessens the utility of the BSIE analyses entitled, "Amounts Awarded Multiple Subject Categories"?

(6) Does VA use, for analytic purposes throughout its hospital system and/or at headquarters, the National Science Foundation series, "Federal Grants and Contracts for Unclassified Research in the Life Sciences"? To what extent and how?

(7) Does VA have any comments on the observations explicit or implicit in the questions mentioned above; namely: "How can Federal agencies maintain the best possible analysis-control system as regards their own research commitment in cooperation with other agencies' systems, so as to allocate money and manpower where they will do the most good?"

I realize and completely respect, of course, the need for freedom of individual investigators in VA research facilities. The questiton is: "How can these investigators in turn, make the soundest possible decision as regards their choice of future research projects if they do not have available, at call or at their fingertips, analyses of who is doing what, where, how, etc., in biomedical research?"

It is my frank impression that a Federal agency, as well as its individual investigators, could utilize far more data, carefully analyzed by subject, than now appears readily available.

I say this, knowing that (*a*) the various agencies are often represented on one another's councils; (*b*) that a certain amount of overlapping is not only unavoidable, but is often indispensable for scientific exploration, and knowing other arguments which have frequently been presented to this subcommittee, which discount the need for more thorough interagency analysis systems.

It is at the interagency level, in my personal judgment, that some of the most salient Federal policy problems in research arise and go at least partly unanswered. That is why I propound these questions and offer these tentative observations at length.

I know, however, that Dr. Middleton and his associates will not hesitate to give me the benefit of their own frank reactions as to the implicit and explicit views expressed above. It is not confirmation that I seek, but facts and sound, expert judgment such as I know are available through VA.

I have a very high regard for VA medical research.

I feel that the research increases which the Congress has granted to VA in recent years are a fitting tribute to the important results achieved to date and are appropriate recognition of the significance of constantly seeking new answers to the medical needs of America's ex-servicemen, as well as the needs of our entire population.

Kindest wishes.

Sincerely,

HUBERT H. HUMPHREY,
Subcommittee Chairman.

EXHIBIT 57

LETTER OF AUGUST 11, 1960, FROM VETERANS' ADMINISTRATION ON USAGE OF INFORMATION ON OTHER AGENCIES' RESEARCH PROGRAMS

VETERANS' ADMINISTRATION,
WASHINGTON, D.C., *August 11, 1960.*

DEAR SENATOR HUMPHREY: Many thanks for your expression of appreciation for any assistance the Veterans' Administration may have provided your subcommittee. I hope we can continue to be of help.

The problems you raise in your letter of July 12, 1960, are of importance and concern to all those who have a responsibility for directing large-scale research programs, particularly in the field of medicine. The tremendous expansion in the scope and complexity of such research, the increased number of scientific disciplines involved, the proliferation of professional journals, and the growing importance of research published in languages not readily translated into English have all combined to make the effectiveness of present communication procedures one of concern to all agencies and persons involved in scientific research.

Having said so much, I wish I could offer some assurance that greatly improved methods of facilitating the exchange of scientific information concerning research proposed, in progress, or published can be expected in the near future. One of the basic problems, of course, is that any given research proposal or report can be considered, technically, from many different viewpoints, the "disease entity" involved being only one of them. For example, the investigator (or the evaluating panel) may be more concerned with such factors as the biologic system and processes involved, the experimental techniques utilized, the subjects, substances, and equipments used or the statistical design or experimental model employed, than with the disease itself. When it is considered that each of these facets involves numerous subsidiary elements, the complexity of our indexing and information retrieval requirements becomes apparent. It is my understanding that a major breakthrough in "information search" technology, involving both the design and engineering of novel equipment, and the development of an adequate theoretical basis or logic for such equipment, will be required before we can effectively resolve this problem. This breakthrough will probably be based on special-purpose machines, possibly computers, which would have the ability to read, analyze, and index technical reports and proposals, and to search its memory for interrelated scientific concepts. It could thus supply not only information on subjects specifically requested, but also information logically related to the subject but not requested. While the development of such machines may not be imminent, they are conceptually no longer an impossibility. What is more to the point, machines with such abilities are what solution of the problem requires.

While some basic work on problems in this area is progressing (with which we in the Veterans' Administration are keeping informed), I must point out that these are not fields of research in which the Veterans' Administration has a primary responsibility. Since I understand you have directed similar inquiries to groups such as the National Science Foundation, the National Academy of Sciences, and the National Institutes of Health, I am confident you will receive from them information more closely related to possible breakthroughs and major improvements in the technology of scientific communication. In the meantime, the Veterans' Administration will continue to do everything that existing communication mechanisms make possible to assure the fullest possible flow of information between investigators within and without the Veterans' Administration, and to insure adequate coordination of research projects concerned with the study of related phenomena. As an example of this, I would like to point out that some 30 large-scale collaborative projects are now being conducted in our 170-hospital system.

Concerning the seven specific questions raised in your letter, I have referred them to our senior research specialists in the Department of Medicine and Surgery. These questions, together with our replies, follow:

(1) Does the VA regard this volume of usage in subject-type requests as adequate in order to avoid the dangers I have mentioned? Or does VA perhaps regard this particular usage statistic not as significantly as the subcommittee does?

You are certainly correct in emphasizing the low volume of requests for Bio-Sciences Information Exchange information by VA during 1959. There are several reasons which may account for this:

(*a*) The BSIE is not the only source from which we obtain information.

(*b*) Until recently, BSIE placed its emphasis on VA extramural programs, rather than on our intramural projects, which constitute the great majority of our studies. Consequently, prior to 1960 it was not particularly useful for our investigators to contact the exchange, since BSIE had information on only 30 percent of our research projects. Although this situation has changed, it will take some time for all VA investigators to acquaint themselves with the usefulness of BSIE information resources. We are actively encouraging the use of the exchange and expect our rate of utilization to increase.

Incidentally, the difference between the 10,403 active projects as reported by the Bio-Sciences Information Exchange and the 6,000 projects as reported by the Veterans' Administration is due to the fact that two phases of a project may be active or concomitant and, thus, recorded twice by BSIE. Only the latest and most significant phase will be used in our report. For several years, the Veterans' Administration annual volume, "Medical Research in the Veterans' Administration," has been based upon project descriptions supplied by the BSIE. Not all studies registered by our investigators are included in our report, as some, while involving important work such as medical case reports, are not included in the annual register of research projects.

(2) What type of analyses by subject as to VA's own current projects is regularly or irregularly available to individuals in the respective VA hospitals, and/or elsewhere, who may screen or otherwise act on proposed new VA research projects?

Similarly, what types of analyses by subject are available to such individuals as regards the nature of National Institutes of Health, Department of Defense, and of other agencies' current research projects, in addition to, for that matter, private organizations?

First, let us describe the procedures generally used in the Veterans' Administration to review and approve new research projects. When a member of the professional staff of a VA hospital wishes to conduct research, he presents his project proposal to the Research and Education Committee at his hospital, where it competes with other proposals for available funds, space, and time. The Research and Education Committee at each hospital has final responsibility for the administration of the research program at that hospital. It systematically reviews the technical progress of all projects, and also oversees such administrative matters as the status of research funds. The results of its deliberations are forwarded periodically to central office. There, the senior research staff members analyze the projects by subject, approach, etc., and provide a channel for coordinating projects or proposals where this seems scientifically indicated. We might point out that it is frequently desirable to have two or more investigators pursue similar studies, so that the results of one can be compared with the results of the other. Our problem is not so much to avoid duplication, as such, but to avoid that duplication in which neither investigator is aware of what the other is doing. These procedures enable the hospital and the senior research staff in central office to keep closely informed on research matters from both a financial and scientific viewpoint.

Information concerning VA research projects can be secured from the annual volume, "Medical Research in the Veterans' Administration," from the Bio-Sciences Information Exchange, from personal and institutional contacts by scientists working in the same fields, and from papers presented at the VA Annual Research Conference and other professional seminars and meetings, or published in scientific journals. Similarly, our investigators make use of information provided by the National Institutes of Health, the Department of Defense, and the Atomic Energy Commission. Information concerning projects in private organizations, which frequently do not print lists of their projects, may be harder to secure.

The information conveyed to the individual researcher (or project evaluation group) by such tabulations, or listings of individual projects by title, is necessarily sparse. Its value is primarily to suggest leads for followup by personal inquiry, correspondence, library research, etc., rather than to provide information of direct value for project design or approval.

(3) Likewise, what types of analyses does VA send regularly or irregularly as to its subject-matter commitment to other agencies' screening echelons so as to assist them?

The previously described annual report, "Medical Research in the Veterans' Administration," is made available to other agencies but is not primarily intended to assist screening echelons. Abstracts of new research projects are forwarded to the Bio-Sciences Information Exchange monthly as they are developed. The Veterans' Administration is represented on several of the National Institutes of Health study sections and national advisory councils, and we hope, as resources permit, to extend this representation.

(4) Does VA actually use throughout its hospital system the analyses of "Amounts Awarded Multiple Subject Categories," as prepared by the Bio-Sciences Information Exchange?

These analyses are principally concerned with the amounts granted by various agencies for research by subject category. Since the Veterans' Administration does not make research grants, but rather conducts its research program almost entirely within its own facilities, this publication is primarily useful for general reference by those responsible for overall program balance in VA medical research efforts. For general information purposes, the Veterans' Administration also classifies its research activities by subject category, such as "Research in Aging," "Cancer Chemotherapy," etc.

We might add that the problem of determining overall balance of effort in funds and resources in a far-flung research program such as VA's, which is a responsibility of our staff in Washington, is a quite different problem from that of appraising and selecting individual research projects, which is a responsibility of each of our hospitals conducting research.

(5) Does VA feel that the absence of statistics on intramural research commitments (VA's, National Institutes of Health's and others) lessens the utility of the Bio-Sciences Information Exchange analyses entitled, "Amounts Awarded Multiple Subject Categories"?

The value of this publication as a general source of information on the relative financial emphasis placed by the Federal Government on different disease entities is somewhat lessened by the omission of statistics on intramural research commitments. However, we would like to emphasize that individual research projects must be considered primarily on their individual merits, and that even from an overall viewpoint, proper program balance involves many considerations other than the level of funds in a given category. For example, opportunities for significant achievements may be much greater in some areas than in others, and the interests and abilities of research investigators may be much greater in some areas than in others.

(6) Does VA use, for analytic purposes throughout its hospital system and/or at headquarters, the National Science Foundation series, "Federal Grants and Contracts for Unclassified Research in the Life Sciences"? To what extent and how?

This publication likewise is of general interest to our senior staff at headquarters, but the types of medical research conducted within the Veterans' Administration have a somewhat different emphasis from those supported by other Federal agencies. In addition, of course, the Veterans' Administration makes no grants, and very few contracts, for research, and therefore, our activities do not have the same impact on universities as do those of other Federal research programs.

(7) Does VA have any comments on the observations explicit or implicit in the questions mentioned above, namely: How can Federal agencies maintain the best possible analysis-control system as regards their own research commitment in cooperation with other agencies' systems, so as to allocate money and manpower where they will do the most good?

The question is very well put and has been of concern both to the Administrator and to me personally. Since the mission, the focus of interest, and the methods of conducting, or supporting research in each of the Federal agencies having such responsibilities vary, I feel each such agency will have to develop an analysis-control system tailored to its own needs. This is not to say, however, that each agency should act in a vacuum—we should, and do, profit from each other's experiences.

Last year, in considering our accomplishments and problems in this field, I asked the National Research Council of the National Academy of Sciences to conduct an evaluation of our medical research program, concentrating on an appraisal of its quality, its overall administration, its resources, and its future needs. The final report of this study is expected soon. We are now exploring the possibility of an additional study, more explicitly directed to the problem of determining optimum project evaluation and selection techniques. On the basis of our studies thus far, I can say without reservation that I am personally

satisfied that the quality of the VA medical research program is excellent, both from the viewpoint of the technical adequacy of its results as measured by professional acceptance, and from the viewpoint of its relationship to the medical care problems of present and potential veteran patients. However, the problem, as you state it, involves not just the assurance that VA's research resources are devoted to needed projects, soundly conceived, and well executed, but that the total of our resources are devoted to those projects most necessary, most important, and most relevant to our mission.

This is a more difficult task we set ourselves, since the results of any research project are seldom predictable with any degree of certainty—in fact, I doubt if a project whose results were known in advance should properly be called research. It is our hope that we will continue to refine the present project selection and coordination procedures in our research program, and, hopefully, test out new ones. In so doing, however, we must not forget that the inspiration and dedication of the individual research investigator is the only truly essential element in any high performance research organization. We now have this element in the Veterans' Administration, and we must take care that in our efforts to achieve even greater effectiveness, we increase, rather than decrease, the opportunities for individual initiative and creativity.

Sincerely,

BRADFORD MORSE, *Deputy Administrator.*

EXHIBIT 58

LETTER OF SEPTEMBER 14, 1960, ON COST OF RESEARCH BY DISEASE CATEGORY AND ON WORK OF FOLLOWUP AGENCY

VETERANS' ADMINISTRATION,
Washington, D.C. September 14, 1960.

DEAR SENATOR HUMPHREY: We are most appreciative of your comments relative to Mr. Bradford Morse's reply of August 11th to the subcommittee's point-by-point inquiry and Dr. Musser's contribution to your August 11th hearing. The tear sheets of pages 105–112 have been reviewed by Dr. Musser and are being returned herewith.

The two other points mentioned in your letter of August 17 can be elaborated upon, as requested.

(1) Why, in your previous listing of categories of VA research projects, various categories were grouped together under a common dollar total, e.g., infectious diseases, digestive tract diseases, etc., rather than being listed with separate funding for each category?

Major programs are designated in areas of disease category, medical or surgical subspecialty (or other), in order to facilitate review as to completeness of coverage in research on problems in these areas. This program designation is newly developing in VA research and appears to offer the best possibility for administrative knowledge to allow full coordination of effort.

Information on the dollar cost of research by disease category was requested by phone from your office sometime earlier. At the time the information was furnished the inquirer was told that our accounting system did not provide cost figures for all the categories—that some of them, such as the ones mentioned in your letter, were grouped together under a general heading. It was not believed that we should arbitrarily distribute the money by these categories without any factual basis nor furnish information not contained in other documents such as the annual report or the research budget.

(2) Your views as to the considerable decline in number of current projects within the followup agency, Division of Medical Sciences, NAS–NRC. It appears to me that the VA study on ulcerative colitis and regional ileitis and many such similar studies of World War II medical cases make use of an invaluable reservoir of still largely untapped information.

There is no considerable decline, in activity within the followup agency, Division of Medical Sciences, NAS–NRC, although the number of projects may have decreased. Readily accessible data and questions answered more simply have given way to more complex problems. In addition, veterans are more widely dispersed and, as time goes on, location of individuals in large numbers becomes more difficult. We agree that such studies as on ulcerative colitis and regional ileitis are unique and could be increased in number and scope if assurance of continuity and level of support is sufficient to allow firm com-

mitments to stations for necessary ancillary staff. The principal investigator for the ulcerative colitis study returned to England following his 1-year tour of duty in our Research Service and the collected data will be reviewed by a biometrician, Dean Nefzger, Ph. D., who is en route to England.

We are in the process of developing the memorandum you requested on the subject, "How This Agency Views the Problem of Interagency Coordination." It will be forwarded to you during the coming week.

Sincerely,

WILLIAM S. MIDDLETON, M.D.,
Chief Medical Director.

EXHIBIT 59

LETTER OF SEPTEMBER 16, 1960, FROM VETERANS' ADMINISTRATION SUPPLEMENTING TESTIMONY AT HEARING AS REGARDS INTERAGENCY COORDINATION

VETERANS' ADMINISTRATION,
Washington, D.C. September 16, 1960.

DEAR SENATOR HUMPHREY: In response to your concluding statement at the August 11 subcommittee hearing, we have attempted to develop a memorandum on the subject, "How This Agency Views the Problem of Interagency Coordination."

(1) Observations on the interagency coordination problem based upon the unique vantage point and special interests of your particular agency.

The mission of the Department of Medicine and Surgery is to provide the best available medical care to eligible veterans. In the fulfillment of this mission, a program of research has been developed. The Veterans' Administration, as a major employer of physicians, should take part in the development of the urgently needed facilities for training more physicians and medical scientists. Research is only completed when it has been published and thereby made available to the entire scientific community. The subject of improving the effectiveness of communication of research results needs continuous study. It is recognized that making advances known to physicians is an inherently difficult problem, so that only by constant attention is it possible to achieve the desired result.

Although the missions of each of the Federal agencies may be different, there are many areas of mutual concern among the medical researchers in each of the Federal agencies engaged in medical research. Cooperation in such mutual efforts as may be consonant with the best interests of the different agencies should be encouraged. This may involve the use of special facilities of one agency for research sponsored by another, cooperative efforts in certain areas of research, combined conferences, cross-dissemination of information, an interagency liaison officer, etc.

(2) Observations on areas—i.e., subjects of overlapping interest with other agencies.

Subjects of overlapping interest with other agencies, as you correctly observed, are virtually inevitable and often very helpful. However, unnecessary duplication should be avoided. Parallel interests with other Federal agencies exist in the areas of cancer, hypertensive cardiovascular diseases, mental diseases, aging, tuberculosis, etc. This is inevitable since the VA has the largest system of hospital beds in the world.

(3) Specific illustrations of cooperation with other agencies in current research: (*a*) VA-Armed Forces Cooperative Study of the Chemotherapy of Tuberculosis; (*b*) VA Pulmonary Function Testing Cooperative Study (with Fitzsimons Army Hospital); (*c*) VA Coccidioidomycosis Cooperative Study (with Armed Forces Hospitals); (*d*) VA Histoplasmosis Cooperative Study (with Walter Reed Army Institute of Research); (*e*) VA Sarcoidosis Cooperative Study (with National Institutes of Health and Armed Forces Institute of Pathology); (*f*) Amyotropic Lateral Sclerosis Study (with National Institutes of Health); (*g*) Solitary Pulmonary Nodules Study (with Armed Forces Hospitals); (*h*) Cancer Chemotherapy Study (with National Institutes of Health); and (*i*) VA Cooperative Study of Diabetes Mellitus (with National Institutes of Health).

All of the above cooperative efforts in research are current and, in some, joint planning took place at the inception of the project. In addition, cooperation in other projects has been obtained from the Bureau of Standards, the Department of Agriculture, and the Atomic Energy Commission.

(4) Specific examples wherein your agency is represented ex officio on another agency's study section, grant council or the equivalent.

A list of VA representatives actively participating in NIH study sections is attached as exhibit A. A proposed VA representation on the grants study sections and councils of NIH is attached as exhibit B.[15]

Sincerely,

WILLIAM S. MIDDLETON, M.D.,
Chief Medical Director.

EXHIBIT A

EX OFFICIO MEMBERS OF ADVISORY COUNCILS' STUDY SECTIONS, AND COMMITTEES OF THE NATIONAL INSTITUTES OF HEALTH

National Advisory Allergy and Infectious Diseases Council—Dr. Marc J. Musser, Director of Research Service, VA, Washington 25, D.C.

National Advisory Arthritis and Metabolic Diseases Council—Dr. Benjamin B. Wells, Assistant Chief Medical Director for Research and Education in Medicine, VA, Washington 25, D.C.

National Advisory Cancer Council—Dr. Lyndon E. Lee, Jr., Chief, Extra-VA Research Division, VA, Washington 25, D.C.

National Advisory Dental Research Council—Dr. J. E. Fauber, Assistant Chief Medical Director, Dental Service, VA, Washington 25, D.C.

National Advisory Health Council—Dr. Marc J. Musser, Director, Research Service, VA, Washington 25, D.C.

National Advisory Heart Council—Dr. William B. Tucker, Director, Pulmonary Disease Service, VA, Washington 25, D.C.

National Advisory Mental Health Council—Dr. J. F. Casey, Director, Psychiatry and Neurology Service, Department of Medicine and Surgery, VA, Washington 25, D.C.

National Advisory Neurological Diseases and Blindness Council—Dr. Warren V. Huber, Chief, Neurology Division, Psychiatry and Neurology Service, VA, Washington 25, D.C.

OTHER COMMITTEE PUBLICATIONS REFER TO INFORMATION PROBLEM

Senator HUMPHREY. I want to reiterate for the purpose of this record that the hearing today, together with our numerous exhibits, do not by any means represent the total exploration of this subject by this committee.

We have been looking at the information problem—both as regards incomplete and completed research, literally for 3 years.

The main effort which we are making to present the story of this problem will be in the form of a forthcoming committee print, "The Federal Government and Biomedical Information." This print, which we referred to earlier, will consist in large part of a series of essays prepared at our invitation by a wide variety of experts in the biomedical information field. In order to develop this print we sent out a comprehensive outline and invitation to several hundred top authorities. Lists of possible contributors were painstakingly compiled by us in conjunction with experts of the Library of Congress' Science Division. The authorities have responded both helpfully and graciously.

Some of the contents of that print interrelate with the contents of this hearing. However, we have left to the present hearing by and large, the detailed examination of problems of inventorying and using current research as such. By contrast, the future print is devoted to problems of biomedical documentation—translating, storing, indexing, abstracting, retrieving data on published articles and monographs.

[15] Not reprinted in this volume. Exhibit B is included in subcommittee's master file.

A separate future committee print will be devoted to the Federal Government and Medical Electronics. It will consider, in detail, the use of electronic data processing methods for analysis of information and for a variety of other research purposes.

Let me also point out that the past basic work on Federal documentation in all the sciences has been the 283-page committee print which was subsequently issued as a Senate document by the Committee on Government Operations as a whole. This report was entitled "Documentation, Indexing, and Retrieval of Scientific Information." In it will be found a summary of activities in the documentation field on the part of several of the departments which are represented here today.

That particular document was compiled under the direction of our staff director-chief clerk who is here with us today, Mr. Walter Reynolds.

SUBCOMMITTEE'S PAST AND PRESENT WORK

So that the past volumes of this subcommittee as such can be readily referred to, I will ask that there appear as an exhibit a list of all the prior publications which have been issued and which are now at the Government Printing Office.

EXHIBIT 60

LIST OF PRESENT AND PAST SUBCOMMITTEE PUBLICATIONS

(Issued pursuant to S. Res. 347, 85th Cong., and S. Res. 42 and 255, 86th Cong.)

COMMITTEE PRINTS

Committee Print No. 1 (S. Rept. 160, 86th Cong.) was entitled "International Medical Research—A Compilation of Background Materials" (117 pp.). It set forth highlights of international research contributions in most of the major fields of disease, in addition to fulfilling other background purposes.

Committee Print No. 2 was entitled "Statutory Authority for Medical and Other Health-Related Research in the U.S. Government—The Basis for International Cooperation" (66 pp.). It contained the texts of the legal authority for medical research efforts by diverse agencies of the U.S. Government.

Committee Print No. 3 (S. Rept. 161, 86th Cong.) was entitled "The Status of World Health—In Outline Text and Chart" (81 pp.). Within it were presented charts on the incidence of certain major diseases throughout the world.

Committee Print No. 4 was entitled "The United States and the World Health Organization—Teamwork for Mankind's Well-Being" (145 pp.). It represented a personal report of the chairman of the subcommittee on the subject of WHO, based upon his conferences with the organization's officials and other authorities in Europe and on subsequent review.

Committee Print No. 5 (S. Rept. 1009, 86th Cong.) was entitled "Cancer—A Worldwide Menace, Some Facts and Figures on Its Incidence in the United States and Abroad" (40 pp.). It presented text and charts on the patterns of occurrence of malignant neoplasms in different countries of the world.

Committee Print No. 6 was entitled "Patterns of Incidence of Certain Diseases Throughout the World—Opportunities for Research Through Epidemiology" (50 pp.). It summarized epidemiological leads on important chronic and degenerative diseases in various nations. These leads, if followed carefully, may provide insight in the chain of discovery as to the cause and cure of maladies.

Committee Print No. 7 was entitled "The National Science Foundation and the Life Sciences" (96 pp.). It described domestic and international activities of the National Science Foundation and, principally, its work in the life sciences.

Committee Print No. 8 (S. Rept. 1038, 86th Cong.) was entitled "Rehabilitation

of the Disabled in Thirty-Seven Countries of the World—Domestic Programs and International Activities in Technical Assistance" (153 pp.). It summarized activities in rehabilitation carried on in the United States and in other nations by official and nongovernmental organizations. The account of the official work abroad included assistance rendered by U.S. Government, foreign government and intergovernmental organizations.

Committee Print No. 9 was entitled "Health in the Americas and the Pan American Health Organization—Program of the Pan American Health Organization of the World Health Organization in the Americas" (105 pp.). It presented a summary of activities of this intergovernmental organization. This included its activity as regards communicable diseases, specific health problems, environmental sanitation, health services and facilities, coordination of research, health manpower as well as PAHO's possible future role.

HEARINGS

Hearings—Part I (310 pp.): Transcript of testimony by medical experts in Washington, D.C., in July 1959 and of discussions in Western Europe in October–November 1958 on long-range trends, opportunities, and challenges in international medical research.

PUBLICATIONS IN PROCESS

Committee Print No. 10—"Radiation Research in the Life Sciences," an analysis of current projects in the United States and throughout the world—with information on the magnitude, organization, and distribution of programs.

Hearing Appendix—Part II—The text of letters, memoranda and articles compiled by the subcommittee from official sources at home and abroad during the period from August 1958—the time of the Senate's authorization of the Study of International Health—through October 1960.

Hearing Appendix—Part III—The text of letters, memoranda and articles compiled by the subcommittee from nonofficial sources during the same period.

COMMENDATION OF NATIONAL INSTITUTES OF HEALTH AND OTHER AGENCIES

Senator HUMPHREY. Before concluding I want to make this point perfectly clear.

To my way of thinking, nothing in this record should be regarded as a reflection on the capabilities of the agencies or the scientists represented today. The fact that certain goals may not have been reached as yet, at least in our judgment, indicates that there are frontiers of opportunity and challenge ahead. It indicates that almost inevitably in a field such as biomedical research (which has jumped from almost no Federal support to hundreds of millions of dollars of support in two decades) some phases such as information and communication might inevitably not have been sufficiently attended to. There has been, I believe, uneven development.

It is easy enough for an observer to point out such uneven development. It is a lot harder to correct it.

I want to emphasize that, after intensive study, the project director of this subcommittee has confirmed to me the enormous achievements of the National Institutes of Health and of the other agencies in a detail which even some of their warmest admirers may not fully appreciate.[16]

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[16] Note.—The chairman of the subcommittee also invites attention to a list of notable advances, significant to the Nation's health which have resulted from concerted national medical research in which NIH funding has played a vital part. This list was submitted by Dr. Shannon to Senator Lister Hill, chairman, and published in the hearings on Labor-Health, Education, and Welfare appropriations for 1961, before the subcommittee of the Committee on Appropriations, U.S. Senate, 86th Cong., 2d sess., on H.R. 11390, pt. I, p. 754.

I want to point out, too, that the Bio-Sciences Information Exchange deserves real commendation for its pioneering.

Our subcommittee viewpoint is constructive. I, for one, want NIH to be a still stronger, more effective arm, just as I want the other Federal agencies to have a still stronger biomedical research program and for BSIE to serve still more valuably.

All that we are seeking today is to enable them to achieve that goal. We would not want any of our questions or the premises of our approach to be used or misconstrued in a negative way. We have kept our approach positive. Our respect for these agencies and their representatives is high and well merited.

COSTS OF DISEASE AND DISABILITY

Throughout this hearing, we have necessarily been referring to expenditures on Federal biomedical research. It would be well, I believe, in rounding out this record if we included a few facts which would help provide perspective on the relationship between these expenditures and a much larger figure—the overall toll taken by disease. The fact that this subcommittee is trying to strengthen the efficiency of research should not be construed as meaning or implying that we are questioning the value of current research outlay. It is not the purpose of this committee to attempt to pass judgment on what the level of appropriations should be; that is the exclusive responsibility under the rules of the Senate of the Committee on Appropriations.

I believe that the following article from the New York Times describing a very important study by the National Health Education Committee will help provide perspective on the relationship which I have pointed out. Even this article, however, cannot describe the intangible human values which are involved and which dwarf any value in dollar signs. Of this, the able authors of the publication which is referred to are fully, deeply, and sympathetically aware.

EXHIBIT 61

ARTICLE ON STUDY BY NATIONAL HEALTH EDUCATION COMMITTEE ON COSTS OF DISEASE AND DISABILITY

[From the New York Times, June 10, 1960]

LACK OF RESEARCH ON HEALTH SCORED

FEDERAL RESEARCH OUTLAY PUT AT A PENNY FOR EACH DOLLAR LOST THROUGH ILLNESS

(By Peter Kihss)

For every $1 that disease and disability cost Americans, the Federal Government is estimated to spend just a bit more than a penny for prevention.

The National Health Education Committee said yesterday that disease and disability take an annual $35 billion toll—88 times the $400 million Federal expenditure on medical research through the National Institutes of Health.

The nonprofit committee, headed by Mrs. Albert D. Lasker, issued an "annual audit" of the Nation's health bill, urging greater National, State, and local appropriations for research and more contributions to voluntary health agencies.

In a statement, Mrs. Lasker said disease and disability costs averaged $194.44 for every man, woman, and child, compared with the research appropriation of $2.22. A Senate consultant group, she said, has urged that the research sum be increased to $664 million, the equivalent of $3.67 a person.

The 52-page "audit" was entitled "What Are We Spending To Save Our Lives Through Medical Research? People Are the Real Capital of the United States."

The report estimated that 2,012,731 lives had been saved because of medical research since 1944, based on reductions in death rates. Such individuals, it estimated, earned incomes totaling $3,900,668,700 in 1958, paying the Federal Government $638 million in income, gift, and excise taxes.

The study gave these estimates on the number of Americans afflicted in some degree with disability:

Mental and emotional disorders	17,000,000
Diseases of heart and circulation, including cerebral vascular diseases (mainly due to arteriosclerosis)	15,800,000
Hearing impairments	15,000,000
Arthritis and rheumatic diseases	11,000,000
Neurological disorders:	
Epilepsy	1,500,000
Parkinsonism	1,500,000
Cerebral palsy	550,000
Multiple sclerosis and other demyelinating diseases	500,000
Muscular dystrophy	200,000
Total	4,250,000
Diabetes mellitus	2,000,000
Cancer (estimated under treatment now)	700,000
Blind total (legally)	345,000

(1,500,000 blind in 1 eye; 9,000,000 children need eye care; 70,000,000 people wear glasses).

The "audit" is available from the committee at 135 East 42d Street at $3.25 a copy.

FOLLOWUP WORK BY SUBCOMMITTEE

Well, we are at the end of the morning here, and we have kept you a long time, and I have just a brief concluding statement.

We had pointed out in the memorandum which had been sent out on July 28 to each of the Federal agencies (see exhibit 3) that we did not presume that in this comparatively brief hearing, we could do more than touch upon a few highlights of the coordination problem, but we were anxious that the record of this conference be as complete as possible. Let me mention, therefore, our future plan.

REVIEW OF TRANSCRIPT

Within the next couple of days, the staff will send to each of the agencies represented here today either a full transcript of the meeting or tear sheets of those particular pages on which an individual spokesman briefly commented. Please review that transcript and make whatever minor technical changes may be necessary.

I believe it would be well to add whatever further comment you might want to make, because we have had to limit many of you this morning. If you wish to expand on your comments, I would appreciate it.

ADDITIONAL INQUIRIES BY SUBCOMMITTEE

Simultaneously, when sending you the transcript, I will ask the staff to follow up on certain of the points mentioned today by addressing specific additional inquiries to the agencies. These inquiries should be responded to by each of the agencies in the form of a memorandum.

But over and above any such inquiries which the staff may send to you, I am going to ask each of the spokesmen here today to prepare a summary statement on the subject of how your agency views the problem of Federal coordination of biomedical research. It doesn't

need to be a long one. Just get right down to it. What your statement should contain will be covered in a memorandum which we will send.

(The memorandum follows:)

EXHIBIT 62

FOLLOWUP MEMORANDUM FROM SENATE SUBCOMMITTEE REQUESTING ADDITIONAL AGENCY VIEWS ON COORDINATION PROBLEM

Memorandum from: Senator Hubert H. Humphrey, chairman, Subcommittee on Reorganization and International Organizations.

Re: Confirmation of request for agency memoranda for incorporation in hearing volume, "Coordination of Activities by Federal Agencies in Biomedical Research."

As indicated in my concluding statement at the August 11 subcommittee hearing, I will appreciate each agency which was represented developing a memorandum on the subject, "How this agency views the problem of interagency coordination."

This memorandum should include: (1) observations on the interagency coordination problem based upon the unique vantage point and special interests of your particular agency; (2) observations on areas, i.e., subjects of overlapping interest with other agencies. (The subcommittee well recognizes, as pointed out previously, that some degree of overlapping is virtually inevitable and is often very helpful. See attached chart—consisting of a staff draft—designed to portray the fact of parallel interests.); (3) specific illustrations of cooperation with other agencies in current research. (Here, we are interested not only in joint participation in technical conferences, symposia, seminars, and the like, which, of course, are important, but instances wherein your agency is actually collaborating in research.) If such collaboration is not current, we will appreciate learning of past instances of actual collaboration—including, possibly, in joint planning from the actual inception of a particular project; and (4) specific examples wherein your agency is represented ex officio on another agency's study section, grant council, or the equivalent.

NO REPETITION OF PREVIOUS RESPONSES DESIRED

It is not necessary for any agency to repeat (except, perhaps, through a passing reference) any information contained in one or more of its substantive replies to previous inquiries by the subcommittee.

Wherever previous agency replies are pertinent to the transcript of this particular volume, such will be printed in whole or in part within it.

FOUR WEEKS FOR REPLY

Each agency is given the widest possible latitude in responding within this theme of coordination.

The memorandum can be of any reasonable length.

It is requested to be transmitted within 4 weeks after date of receipt of this memorandum.

Senator HUMPHREY. Your statement should include a brief summary of the specific ways, with illustrations, of how your individual agency collaborates with other agencies on current research.

No such memorandum is necessary, of course, in the case of the National Institutes of Health, which have been covered by Dr. Shannon in his testimony today, and on which we have previously sent numerous inquiries.

I know, Dr. Shannon, that we have considerable documentation from you on this.

We will allow 4 weeks after the date the other agencies receive our inquiry with today's transcript for their response. We hope that proves to be ample time.

The reason for the time limit is we just simply have to get some of these things put together for our reporting purposes. Our committee study has only a certain period of life, under the resolution and the appropriation.

I pointed out earlier the very heavy workload which this subcommittee and its staff face.

ADDITIONAL AGENCIES NOT PRESENT AT HEARING

Senator HUMPHREY subsequently stated: In inviting representatives of various agencies, the subcommittee recognized that it could not hope to secure the presence of spokesmen of all of the many additional Federal departments and agencies which support some biomedical research functions.

We concentrated, therefore, upon those agencies which perform the principal proportions of Federal research work. A number of other agencies are, however, definitely interested in this general field.

In order to make this transcript relatively complete, therefore, a letter and memorandum were conveyed to them inviting written reactions.

Where particular circumstances appeared to make it desirable, certain additional specific questions were asked of the agencies, over and above the uniform-type inquiries presented in the memorandum which was sent to each and every one of them.

These special questions, tailored to the interest of the individual agency are to be reprinted hereinafter along with the agency responses.

Our standard outgoing letter and memorandum will appear, followed by printed responses from the various agencies: Food and Drug Administration, Department of Health, Education, and Welfare; Federal Aviation Agency; Bureau of Commercial and Sports Fisheries, Fish and Wildlife Service, Department of Interior; International Cooperation Administration.

CHART ON OTHER AGENCIES' RESEARCH

At the conclusion of the various agencies' replies will appear a large-scale chart (exhibit 69), which utilizes data from agencies which were represented as well as from agencies not represented at the hearing. This chart will seek to tell for other agencies of the U.S. Government the type of comprehensive statistical story as to research projects which a comparable chart (exhibit 9) told for the National Institutes of Health.

Preceding exhibit 69 will be a background note, which points out why the non-N.I.H. Government-wide chart must be construed only as a preliminary draft for purposes of further review.

Comparison between contents in the two charts will, we feel, prove helpful.

It should be noted that the various statistics of projects within these two charts have been available to the legislative branch only in part, heretofore. The fact is that some of this material has never before been compiled, much less printed. We hope that its printing herewith will help add to the big picture.

USEFULNESS OF CHARTS

Senator HUMPHREY. As is clear, we have devoted a considerable effort toward the preparation of this type of graphic material. We have done so in order to conserve the time of our readers and in order to make very clear relationships which might otherwise remain relatively obscure within long paragraphs of text.

I should like to say that the subcommittee's charts have drawn many favorable comments. Several have been reproduced in large numbers.

The Committee on Government Operations as a whole, it will be recalled, has pioneered in charts on the organization of the U.S. Government. It was logical, therefore, for this subcommittee to follow through similarly in this particular study.

CHEMICAL CORPS RESEARCH

Senator HUMPHREY. One of the additional phases of Federal biomedical research on which the subcommittee staff has compiled information bears upon the work of the Chemical Corps, Department of the Army. Its total of research projects and their dollar volume are included within exhibit No. 69—the chart containing Government-wide information on biomedical research. For several reasons, however, we have not attempted to explore the Chemical Corps research in detail.

It is obvious that a subject of this significance and with such immense ramifications should be studied only if there are adequate time and resources. As we have indicated several times within this volume, so broad is the other subject matter of this subcommittee that we could not attempt to do justice within the limited time and resources available to this particular subject—the Chemical Corps research, as it relates to the work of other agencies. Other committees of the Congress have, of course, devoted time to this important subject. We believe, however, that the record of this volume would not be complete if we did not at least include, as the final letter exhibit, the text of a response which we had received last year in response to our invitation. It is from the chief chemical officer, Department of the Army, Maj. Gen. Marshall Stubbs. The letter (exhibit 68) touches upon the principal working relationships of the Chemical Corps with other Government agencies. It is reprinted as an indication of another—but singular—phase of the Federal problem of interagency cooperation.

APPENDIX ON HOOVER STUDIES

Senator HUMPHREY. The most detailed of the staff memoranda which will, as previously noted, appear in the appendix of this volume summarizes findings by the two Hoover Commissions in 1949 and 1955, pertinent to problems of interagency coordination.

I hope that this appendix will save scholars many hours of effort in searching through libraries for this information, particularly Commission comments that are to be found in numerous separate volumes.

Let it be noted that this memorandum bears upon Hoover findings relating to substantive coordination of research, not merely coordination of information on research.

CONCLUDING COMMENTS AT HEARING

If there is anyone else who wants to make a comment, we would be more than happy to receive it. Would any of you gentlemen here like to be heard?

(No response.)

Senator HUMPHREY. If not, I want to thank you on behalf of the committee for your cooperation and for your patience. Good day.

(Whereupon, at 12:45 p.m., the subcommittee adjourned.)

EXHIBIT 63

SUBCOMMITTEE MEMORANDUM CONVEYED TO AGENCIES WHICH DID NOT PARTICIPATE IN AUGUST 11, 1960, HEARING, INVITING THEIR VIEWS AND REPORT ON INTERAGENCY COORDINATION OF BIOMEDICAL RESEARCH

August 18, 1960.

Memo from Senator Hubert H. Humphrey, chairman, Subcommittee on Reorganization and International Organizations.

PURPOSE

My purpose is to request a memorandum on the theme, "How this agency (division or bureau) views the problem of coordination of Federal activities in biomedical research."

Your memorandum will be printed as an exhibit in a hearing volume, consisting of testimony before this subcommittee by representatives of nine Federal agencies on August 11, 1960.

Federal agencies with comparatively small programs were not asked to attend the hearing.

Their comments are nonetheless desired for inclusion as appendixes in the hearing volume.

AUTHORITY

The hearing was held pursuant to Senate Resolution 255, section 4, 86th Congress, for a study of interagency coordination.

CONTENTS

Your memorandum should consist of two phases: (1) Facts as requested below; (2) judgment, also as indicated below—but on any other phase, specified or not, which you regard as pertinent to the topic of hearing volume; namely, interagency coordination in biomedical research.

FACTS REQUESTED

If you have not already so informed the subcommittee, kindly include in the memorandum a table, showing the following for fiscal year 1960 for (*a*) intramural and (*b*) extramural research:

Principal categories of projects in biomedical research	Number of projects	Dollar volume

followed by a summary for (*a*) and (*b*), then for (*a*) and (*b*) combined: (1) total number of projects; (2) total dollar volume of projects.

(See attached page for a sample table, as furnished by the Veterans' Administration.)

REQUESTED FACTS AND JUDGMENT

Please specify (*a*) whether your agency registers projects with the Bio-Sciences Information Exchange (through 300-word summaries); (*b*) if not, why not; (*c*) if not, too, whether you intend to register projects in the future; (*d*) whether you do or do not register, why your agency (like virtually all Federal agencies) addresses few subject-type inquiries to the Exchange.

(The committee finds over 30,000 active projects registered with the Exchange and 19,000 terminated projects, yet relatively few subject-style inquiries drawing upon this vast storehouse of data.)

INTERAGENCY OVERLAPPING AREAS

Please note the attached chart on overlapping areas of agency interests.

Please indicate (*a*) with which Federal agency or agencies (and which particular divisions) your organization shares principal interests in biomedical research; (*b*) what steps you have taken or intend to take to assure interagency coordination, including two-way flow of information on current research; (*c*) whether your organization is actually collaborating on any particular research with another agency, e.g., through joint planning, joint finding and/or joint implementation.

ILLUSTRATION

An example of common interest is in the field of evaluation of effects—direct and indirect—of chemicals on human beings. This interest is shared, among others, by Department of Agriculture, Agricultural Research Service; Department of Health, Education, and Welfare, Food and Drug Administration and Public Health Service; Department of Interior, Fish, and Wildlife Service.

Accordingly, the type of question whose answer is of interest to the subcommittee is: Exactly how does organization A know what organization B is currently researching in, let us say, the effects of herbicides, fungicides, pesticides, etc.—e.g., through what type of exchange of current information, how, to whom, when?

While the above questions are numerous, our principal interest is in your own views and recommendations.

FLEXIBILITY SOUGHT

You may be assured that the subcommittee does not believe in pro forma coordination for coordination's sake—i.e., in (*a*) needless exchanges of possibly unwanted or unusable information among agencies; (*b*) needless expenditure of time on proliferated interagency committees.

Rather, the subcommittee seeks flexible ways and means, pragmatically determined by agency experts so as to assure interagency efficiency and mutual service.

TIME FOR RESPONSE

Each agency is asked to respond within 4 weeks of receipt of this request.

Enclosed: Chart on overlapping interests and Veterans' Administration table.[17]

EXHIBIT 64

LETTER OF SEPTEMBER 30, 1960, FROM FOOD AND DRUG ADMINISTRATION ON ITS VIEWS ON INTERAGENCY COORDINATION OF BIOMEDICAL RESEARCH

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,
FOOD AND DRUG ADMINISTRATION,
Washington, D.C., September 30, 1960.

DEAR MR. CHAIRMAN: Pursuant to your letter of August 19, 1960, requesting information on interagency coordination of biomedical research in the Food and Drug Administration's field of activity, we are attaching a memorandum with the desired information.

Sincerely yours,

GEO. P. LARRICK,
Commissioner of Food and Drugs.

[17] See exhibit 5 for chart and exhibit 69 wherein Veterans' Administration table is reproduced along with other tables (which resulted from this outgoing memorandum of request).

MEMORANDUM ON INTERAGENCY COORDINATION OF BIOMEDICAL RESEARCH BY THE FOOD AND DRUG ADMINISTRATION FISCAL YEAR 1960

1. Comments on the use of the Bio-Sciences Information Exchange

(*a*) The Food and Drug Adminstration does not, at the present time, register its research projects with the Exchange.

(*b*) Research projects have not been registered with the Exchange because many projects are part of an enforcement investigation and must be kept confidential.

(*c*) We intend to register those projects which are not directly related to enforcement investigations or court actions and which are of general scientific interest. We will consider the possibility of registering research projects directly related to enforcement activities when the need for maintaining confidentiality of the data has passed.

(*d*) Our Bureau of Medicine receives and reviews registered projects listed by the Exchange in specific categories. Other scientific units in the Food and Drug Administration expect to use the facilities of the Exchange.

2. Interagency overlapping areas

(*a*) The Food and Drug Administration shares principal interests in biomedical research with the following agencies and units in specified agencies:

Agency	*Unit in agency*
Department of Agriculture	Agricultural Research Service.
Department of Health, Education, and Welfare	Public Health Service, Children's Bureau.
Department of the Interior	Fish and Wildlife Service.
Department of Defense	Naval Medical Center.
	Walter Reed Hospital.
	Air Force Research Development Command, Andrews Air Force Base.
Department of Commerce	Bureau of Standards.
Veterans' Administration	Bureau of Medicine.

(*b*) Interagency coordination for each and within each of the eight principal categories of biomedical research projects listed (table 1) varies from actual collaboration on specific research projects, to continuous consultation on a formalized basis, to occasional consultation. The Food and Drug Administration utilizes the facilities of the Association of Official Agricultural Chemists as the principal means for collaborative studies on methodology for the examination of foods, drugs, and cosmetics as well as for a two-way flow of information on current research. While the bulk of such collaborative studies concern chemical methods of examination, and, as such, would not come under biomedical research, some would fall into this category. Since the Association of Official Agricultural Chemists exercises a coordinating effect upon research by governmental agencies and industrial firms in the food, drug, and cosmetic industries, we have taken the liberty of enclosing a statement on the organization and functions of this association (exhibit A).

(*c*) The type of collaboration between the Food and Drug Administration and other governmental agencies is presented in table 2 for each of the principal categories of biomedical research projects. To make our response as specific as possible, examples of collaborative research projects are listed further by subcategory or individual project.

3. Additional judgments

Many scientists in the Food and Drug Administration believe that the usual channels for the communication of information between groups having similar interests, i.e., scientific journals, meetings of local and national scientific societies, seminars, personal contacts, are the most valuable means for exchange in Federal agencies as well as in private research organizations.

The Food and Drug Administration encourages attendance of its scientists at scientific meetings and interagency conferences.

The Food and Drug Administration has made its laboratory facilities and the knowledge of its scientific staff available in the solution of research problems presented by other governmental agencies whenever these problems have been pertinent to the activities of the Food and Drug Administration.

TABLE 1.—*Intramural and extramural biomedical research, fiscal year 1960*

Principal categories	Intramural		Extramural		Total	
	Number of projects	Dollar volume	Number of projects	Dollar volume	Number of projects	Dollar volume
Clinical investigation of drugs for human use	22	$51,400	2	$1,300	24	$52,700
Clinical investigation of veterinary drugs	21	65,400	5	18,600	26	84,000
Clinical investigation of therapeutic devices	4	8,300	0	0	4	8,300
Nutrition studies	22	48,900	0	0	22	48,900
Investigation of adverse reactions from drugs	22	122,600	1	3,200	23	125,800
The development of biological methods for examination of foods, drugs, therapeutic devices and cosmetics	48	258,500	0	0	48	258,500
Studies on the toxic effects of substances, including pesticides, colors and other chemicals added or proposed to be added to foods, drugs and cosmetics	210	251,500	0	0	210	251,500
The development of biomedical data necessary for the effective enforcement of the Federal Food, Drug and Cosmetic Act, not included in previous categories	16	77,400	1	15,200	17	92,600
Total	365	884,000	9	38,300	374	922,300

TABLE 2.—*Coordination of research between FDA and other Federal agencies, by principal categories of projects*

Category	Methods of coordinating research	Federal agencies involved	Projects coordinated, specific titles, where applicable
1. Clinical investigation of drugs for human use.	1. Reports at scientific meetings and by publications.	1. Various	1. Various.
	2. Membership in WHO expert panel on antibiotics.	2. Various	2. Various.
2. Clinical investigation of veterinary drugs	1. Reports at scientific meetings and by publications.	1. ARS (USDA)	1. Various.
	2. Membership on committees of scientific organizations.	2. ARS (USDA)	2. Various.
	3. Joint collaboration on specific projects	3. ARS (USDA)	3. Rate of disappearance of antibiotic and other veterinary drugs in cow's milk following injection.
3. Clinical investigation of therapeutic devices.	1. Medical staff officer also on reserve staff of AFR & D Command re research on life sciences.	Air Force Research and Development Command (DOD).	1. Ozone, toxic effects.
	2. Frequent consultation	Bureau of Standards (D.C.) SEC (PHS)	2. Various.
4. Nutrition studies	1. Reports at scientific meetings and by publications.	1. Various	1. Various.
	2. Membership on committees of scientific organizations and government agencies.	2. Various	2. Various.
	3. Joint collaboration	3. (*a*) Regional Research Laboratories of USDA.	3. (*a*) Nutritional value of heated fats.
		(*b*) NIH	(*b*) Vitamin D assays.
5. The investigation of adverse reactions from drugs.	1. Membership on committees of scientific organizations and government agencies.	1. Various	1. Various.
	2. Joint collaboration	2. Naval Medical Center, Walter Reed Hospital (DOD), PHS hospital, Baltimore, Md.	2. Routine reporting to FDA of adverse reactions to drugs.
6. The development of biological methods for examination of foods, drugs, therapeutic devices and cosmetics.	1. Participation in AOAC collaborative studies.	1. PHS, ARS (USDA)	1. a. Shellfish poisons. b. Microbiological methods for pantothenic acid. c. Identification of meats by serological tests. d. Microbiological tests for preservatives.
	2. Attendance at scientific meetings	2. Various	2. Various.
	3. Training programs on use of biological methods.	3. PHS	3. Detection antibiotic residues in milk.
7. Studies on toxic effects of substances, including pesticides, colors, and other chemicals added or proposed to be added to foods, drugs and cosmetics.	Reports to other interested agencies through staff meetings.	ARS, AMA } USDA	Toxic effects of crotalaria seed, a contaminant of grains in the Southeastern States. Antibiotic and pesticide residues in milk and dairy products.

a. Substances suspected to be carcinogens. b. Pesticides other than a.	a. Frequent consultation b. Routine consultation	a. National Cancer Institute (NIH) b. ARS	a. Various. b. Provisions of sec. 408 of the FD&C Act provide for consultation with pesticide regulation branch, ARS on all pesticides for which petitions are filed.
8. The development of biomedical data necessary for the effective enforcement of the Federal FD & C Act, not included in previous categories.	1. AOAC collaborative studies 2. Reports at scientific meetings, and publications. 3. Joint collaboration	1. USDA F. & W.S 2. Various 3. F. & W.S	1. Various. 2. Various. 3. Government industry cooperative oyster research program includes scientific personnel from FDA and F. & W.S. working under an independent Scientific Director.

EXHIBIT A

THE ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS

The Association of Official Agricultural Chemists, more familiarly known as the AOAC, is the professional organization of State and Federal chemists devoted to developing, testing, and sponsoring improved methods for the analysis of fertilizers, soils, foods, feeds, pesticides, drugs, cosmetics, caustic poisons, and other materials related to agricultural pursuits. It was organized in 1884 by the State and Federal chemists who were in charge of enforcement of State fertilizer laws, or who, as members of agricultural experiment stations or the U.S. Department of Agriculture, were interested in practical and scientific applications of fertilizers to crops. The form of organization is one in which voting is restricted to official chemists, but discussion is open to all chemists. Four meetings prior to 1884 had failed to produce a cohesive and stable organization of both official and commercial chemists. This final organizational form was settled upon with the full cooperation and even insistence of commercial chemists. They agreed on the principle that since it was the official chemists who had the responsibility for the enforcement of the laws, they also had the responsibility for the choice of valid methods of analysis for this purpose.

As the regulatory control of other commodities such as foods, feeds, drugs, cosmetics, caustic poisons, and pesticides became a recognized governmental function, the work of the association expanded. It has accepted the responsibility of providing the regulatory scientist with accurate and reproducible methods of analysis that are required for the enforcement of laws and regulations. This is accomplished through adherence to a fundamental constitutional requirement that methods approved by the association be subjected to collaborative study. In this, a number of representative chemists analyze the same samples by the proposed method to demonstrate its accuracy and reproducibility in their hands. At the present time about 250 chemists, designated as associate referees, are studying methods of analysis grouped in about 50 general categories from "Agricultural Liming Materials" to "Waters." Not all of them are official chemists; many are industry chemists, who because of their specialized knowledge and experience, also participate in the development and testing of methods of analysis. The results of the studies of these associate referees form the basis for the actions of the association in its approval or disapproval of methods.

All State chemists including those of universities and experiment stations are members of the association. Federal organizations represented in the association are: Food and Drug Administration, Public Health Service, Department of Agriculture, Department of Defense, Internal Revenue Service, and National Bureau of Standards.

The laws enforced by the AOAC members require objective, scientific evidence for their successful application. The AOAC attempts to provide for both industry and Government a common meeting ground for discussion, at a scientific level, of methods of analysis that will be used to obtain this evidence. That this has been successful is indicated by the facts that some State laws specify the use of AOAC methods, where applicable; the Federal definitions and standards of identity for many foods incorporate AOAC methods into their requirements; many Federal specifications and private contracts utilize AOAC methods; and AOAC methods have been quite generally accorded a preferred status in court testimony. Most important of all, the general recognition of AOAC methods removes from the realm of controversy the scientific question of relative validity and merits the available methods of analysis. This is settled by the scientists themselves on the basis of the facts developed during their collaborative studies.

Results of 73 years of work by the members of the association are embodied in its primary publication Official Methods of Analysis of the Association of Official Agricultural Chemists, now its eighth edition (1955). This publication is a 1,000-page laboratory manual which includes 41 chapters, 90 pages of tables, and 45 pages of index. It is an authoritative source of methods of analysis for the regulatory chemist and the agricultural scientist throughout the world. It

is supplemented by the quarterly journal which publishes the transactions of the association including the annual changes in methods adopted by the association, the reports of the referees, and contributed papers containing new methods, new applications, and authentic or interpretive data.

The association deals only with methods of analysis. Matters involving legislation, definitions, administrative policy, and interpretation of laws are dealt with in related offiical organizations; the Association of Food and Drug Officials of the United States, Association of American Fertilizer Control Officials, Association of American Feed Control Officials, and Association of American Pesticide Control Officials. The AOAC maintains formal and informal cooperative arrangements with other scientific societies dealing with methods of analysis to maintain uniformity. Among these are the American Public Health Association (standard methods for the examination of dairy products) American Oil Chemists' Society (nitrogen, fats, and oils), American Society of Brewing Chemists (malt beverages), Joint Committee on Uniformity of Methods of Water Examination (waters), and American Society of Enologists (wines).

MARCH 1957.

EXHIBIT 65

LETTER OF SEPTEMBER 16, 1960, FROM FEDERAL AVIATION AGENCY ON ITS VIEW ON INTERAGENCY COORDINATION OF BIOMEDICAL RESEARCH

FEDERAL AVIATION AGENCY,
Washington, D.C., September 16, 1960.

DEAR SENATOR HUMPHREY: The members of the staff of the Federal Aviation Agency are grateful to the Subcommittee on Reorganization and International Organizations for the opportunity to supply the subcommittee formalized information in regard to this Agency's activity in current biomedical research. Judgment will also be reflected in the enclosed memorandum on "How the Federal Aviation Agency Views the Problem of Coordination of Federal Activities in Biomedical Research."

It is the intent of the Agency by this memorandum to clearly and factually present all of the information you requested. The enclosure follows the outline as suggested in your memorandum of August 18, 1960. We hope that this will give you all the information you desire. Further expansion in any area will be provided at your request.

Sincerely,

JAMES T. PYLE, *Acting Administrator*
(For E. R. Quesada, Administrator).

HOW THE FEDERAL AVIATION AGENCY VIEWS THE PROBLEM OF COORDINATION OF FEDERAL ACTIVITIES IN BIOMEDICAL RESEARCH

The Bureau of Aviation Medicine of the Federal Aviation Agency has taken positive steps to prevent duplication of effort in its civil aviation activities in biomedical research. The steps taken will be developed here using the format in the memorandum which requested this information.

FACTS REQUESTED

A. Intramural research.—Fiscal year 1960 was a year in which we laid out our areas of interest and designed our program to meet our responsibilities designated by law, viz: Medical aspects to support the safety of civil aviation operations. This included plans for the establishment of laboratories for a civil aeromedical research institute in Oklahoma City and a clinical research branch at Georgetown University Hospital. Key personnel to organize and staff these facilities were procured. For this reason our intramural research effort was limited. Of the total $682,100 spent by the Bureau of Aviation Medicine for intramural aeromedical research, $453,300 was spent for equipment and $228,800 for all other inhouse expenses.

B. Extramural research

Principal categories of projects in biomedical research	Number of projects	Dollar volume
Age as it influences human health and capabilities in civil aviation activities	1	$26,785
Safe mass transport of unselected passengers derived from the general population	2	90,488
Human factors aspects of civil aviation accidents	1	14,950
Medical techniques suitable for efficient screening and evaluation of civil aviation personnel throughout the general population	4	74,771
Biological stress problems unique to civil aviation (duration of flight, toxic hazards, disturbance of diurnal cycle associated with aviation activities)	2	5,000
Medical study and planning for forthcoming civil aviation vehicles and supporting equipment	1	35,945
Total	11	248,000

In summary, a total of $930,100 was expended for the combined effort the first year of existence. Two-thirds of this sum was spent for laboratory equipment, and the remainder on 11 projects.

During this formative year, the following project areas were delineated as those representing our areas of interest and responsibility:

1. Medical factors related to personnel groups which are essentially unique to civil aviation: crop dusters, air traffic controllers, stewardesses, female pilots.
2. Age as it influences human health and capabilities in civil aviation activities.
3. Safe mass transport of unselected passengers derived from the general population.
4. Human factors aspects of civil aviation accidents.
5. Medical techniques suitable for efficient screening and evaluation of civil aviation personnel throughout the general population.
6. Biological stress problems unique to civil aviation: duration of flight, toxic hazards, disturbance of diurnal cycle associated with aviation activities.
7. Biological stresses generated in the general population as a result of civil aviation activities.
8. Medical study and planning for forthcoming civil aviation vehicles and supporting equipment.
9. Medical coordination and planning in association with other agencies and facilities.

REQUESTED FACTS AND JUDGMENT

The Aeromedical Liaison Branch of the Bureau of Aviation Medicine has utilized the services of the Bio-Sciences Information Exchange of the Smithsonian Institution to the extent of submitting specific information requests on several life-sciences categories. These requests have been for information pertaining to studies on the physiological and psychological aspects of aging, both very broad subject categories. It is our intent to use the initial information received as a general bibliographic title guide on which to base requests for more intensive and more particular title inventories and subject summary reviews.

Of our 11 aeromedical research contract proposals approved, 9 will lend themselves to review by the contractors for inclusion in the biosciences inventory. Five of these nine are still in the letter-of-intent negotiation stage. It is planned to have all available contractor sources submit a 300-word project summary for the Bio-Sciences Information Exchange with the initial progress report of their research contract. Upon implementation of this plan, the Bureau of Aviation Medicine will have completed formal liaison with the exchange and will be an actual participating member.

INTERAGENCY OVERLAPPING AREAS

A. Federal agencies with which the Federal Aviation Agency shares principal interest in biomedical research are:

1. Department of Health, Education, and Welfare: National Institutes of Health.
2. Department of Defense:
   (*a*) Air Force: Aerospace Medical Center, Air Research and Development Command.

(*b*) Army: Armed Forces Institute of Pathology, Medical Research and Development Command.

(*c*) Navy: School of Aviation Medicine, Medical Acceleration Laboratory, Office of Naval Research, Naval Medical Research Institute.

3. National Aeronautics and Space Administration: Office of Life Sciences Programs.

4. Atomic Energy Commission: Biological Medical Division.

5. Veterans' Administration.

6. National Science Foundation.

B. In an effort (1) to insure our knowledge of the research projects being carried out in other agencies and research facilities, (2) to activate a two-way flow of such knowledge, as well as (3) to reflect the views of medical experts outside of the agency, a Research Advisory Group was established. This group advises the Bureau of Aviation Medicine on the adequacy and acceptability of contract proposals from the viewpoints of scientific design, technological adequacy of the institutional facilities available to the contractor, capabilities and professional reputation of the investigators, research contract funds budgeted, and various policy considerations. These policy considerations include such factors as research already accomplished and priority requirements of both the agency and the aviation community.

The members of the Research Advisory Group have been selected on the basis of the diverse specialties, knowledge of overall research being conducted throughout the country and their potential to work as an integrated group to contribute to contract negotiations and research accomplishment.

The current group is comprised of representatives from the following organizations: Division of Cardiology, Georgetown University Hospital and School of Medicine; Section on Aging, National Institutes of Health; Research Grants Review Branch, Division of Research Grants, National Institutes of Health; Section on Theoretical Statistics and Mathematics, Biometrics Branch, National Institutes of Health; National Bureau of Standards, Department of Commerce; Laboratory of Psychology, National Institute of Mental Health, National Institutes of Health; Center for Aging Research, Division of General Medical Sciences, National Institutes of Health; Office of Naval Research, Bureau of Medicine and Surgery, Department of the Navy; Office of the Surgeon General, U.S. Army; Office of the Surgeon General, U.S. Air Force.

Since the age range of personnel in civil aviation activities is great and because it is necessary to relate personnel performance requirements to physiological capability, longitudinal studies of the effect of the aging process on performance have to be made. To strengthen our aging studies we have taken every step to coordinate this activity with other agencies. The Director of the Section on Aging of the National Institutes of Health has acted in an advisory capacity in the planning of the Federal Aviation Agency research aging studies. In addition, a Research Advisory Board on Aging has been established to meet the demands of the relationship of aging to pilot performance in aircraft. The seven members of the board have been selected on the basis of their outstanding achievement in the development of knowledge of the aging processes. Some of these board members are staff officers of universities receiving grants-in-aid for aging studies. In this manner the combined efforts of the top experts in the field are brought together to bear quickly and without duplication on the most pressing medical research problems in aging for the agency.

In addition to the above-mentioned coordinating groups, a liaison committee, comprised of the Civil Air Surgeon and members of the Research Requirements Division of the Bureau of Aviation Medicine in the Federal Aviation Agency, and the Director of the Office of Life Sciences Programs of the National Aeronautics and Space Administration, has been established.

C. Joint agency interest in a single research subject is illustrated by the combined efforts expended in the further refinement and application of ballistocardiography as a diagnostic and prognostic technique. This laboratory procedure promises to be of great significance in the screening of applicants for pilot certification. By its use, one is able to evaluate normal heart function and detect the presence of heart or circulatory disease. This interest is shared, among others, by the Department of Health, Education, and Welfare (National Heart Institute, General Medicine and Experimental Therapeutics, Section on Cardiodynamics), and the Federal Aviation Agency (Bureau of Aviation Medicine, Research Requirements Division). This represents a working collaboration between the two agencies, but the work is being carried out at the Clinical

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Center, National Institutes of Health. The Department of Health, Education, and Welfare is providing most of the equipment, personnel, and funds for this project. The Federal Aviation Agency representatives have provided technical advice on certain types of electromechanical instruments needed and are collaborating on experimental design and evaluation of clinical results.

SUMMARY STATEMENT

To assure interagency efficiency and mutual service in biomedical research, the Bureau of Aviation Medicine of the Federal Aviation Agency has established the following coordinating groups: (*a*) the research advisory group; (*b*) the Research Advisory Board on Aging; (*c*) liaison committee between FAA and NASA.

EXHIBIT 66

LETTER OF OCTOBER 3, 1960, FROM FISH AND WILDLIFE SERVICE ON ITS VIEW ON INTERAGENCY COORDINATION OF BIOMEDICAL RESEARCH

U.S. DEPARTMENT OF THE INTERIOR,
Washington, D.C., October 3, 1960.

DEAR SENATOR HUMPHREY: In further response to your request of August 24, we are enclosing tabulations of fish and wildlife research projects of or related to a biomedical character showing category, number of projects, and dollar volume.

Regarding your questions about the Bio-Sciences Information Exchange, the Fish and Wildlife Service has not registered its projects with this clearinghouse. The reason for this is that fish and wildlife research is a rather small and highly specialized activity, and there are available efficient vehicles and channels of communication which serve a comparable purpose. Owing to the circumstances it is doubtful whether projects will be registered with the Exchange in the future. The Service addresses few inquiries to the Exchange inasmuch as registered projects bearing on the fish and wildlife resource occur with such low frequency.

Our most productive coordination and cooperation is that accomplished at field level through the personal associations of our individual staff members with scientists having related interests in other agencies.

The Service shares principal interests in projects of a biomedical research nature with the following Federal agencies: (1) U.S. Public Health Service—Communicable Disease Center, Division of Water Supply and Pollution Control, Institute of Allergies and Tropical Medicine, Section of Laboratory Animal Diseases; (2) U.S. Department of Agriculture, Agricultural Research Service—Plant Pest Control Division, Entomology Research Division, Section of Parasites, Section of Animal Diseases, Forest Service; (3) Department of Defense—Armed Forces Institute of Pathology, Walter Reed Institute of Research, Naval Medical Research Institute.

A two-way flow of information on current research and interagency coordination is insured through regular committee meetings of groups such as the Interdepartmental Committee on Pest Control, through frequent meetings of liaison representatives of the respective agencies, and through direct correspondence and personal contact among members of the several research staffs.

At the present time the Service is actively collaborating on research of a biomedical nature with the following: (1) Agricultural Research Service—On parasites common to wildlife and domestic animals and on pesticide-wildlife relationships; (2) Walter Reed Institute of Research—On blood parasites of mammals and encephalitis in birds; (3) U.S. Public Health Service—On virus tumors in mammals, rabies, distemper, and pesticidal contamination of water supplies.

Investigations of the epidemic of trout hepatoma are being undertaken in cooperation with various private hatcheries and fish feed manufacturers, universities, State conservation departments, and such interested Federal agencies as the National Cancer Institute and the Food and Drug Administration.

Sincerely yours,

ROSS LEFFLER, *Assistant Secretary.*

BUREAU OF SPORT FISHERIES AND WILDLIFE

Wildlife research projects related to biomedical research, fiscal year 1960

Category	Intramural		Extramural		Total	
	Number of projects	Dollar volume	Number of projects	Dollar volume	Number of projects	Dollar volume
Waterfowl management			[1] 1	$4,500	1	$4,500
Pesticide-wildlife relationships [2]	11	$90,000	2	6,200	13	96,200
Diseases and parasites	19	139,000			19	139,000
Total	30	229,000	3	10,700	33	239,700

[1] Involves methods of controlling mosquitoes without destroying marsh values.
[2] Does not include field studies of wildlife population changes following pesticidal applications. Total pesticide-wildlife research program involves 32 projects at cost of $185,000.

Fishery research projects related to biomedical research, fiscal year 1960 (all intramural)

Category	Number of projects	Dollar volume
Fish pathology	52	$191,000
Fish nutrition	73	205,000
Fish-pesticide research	15	62,000
Total	140	458,000

EXHIBIT 67

LETTER OF OCTOBER 17, 1960, FROM INTERNATIONAL COOPERATION ADMINISTRATION ON ITS VIEW OF INTERAGENCY COORDINATION OF BIOMEDICAL RESEARCH

INTERNATIONAL COOPERATION ADMINISTRATION,
Washington, D.C., October 17, 1960.

DEAR SENATOR HUMPHREY: In accordance with the instructions contained in your memorandum H–8–3–60 transmitted by your letter of August 18, 1960, we have prepared the attached data on the theme, "How the Office of Public Health of International Cooperation Administration Views the Problem of Coordination of Federal Activities in Biomedical Research."

We appreciate the opportunity to comment, and we concur wholeheartedly in the objective of bringing about improved interagency efficiency and mutual service in the area of biomedical research.

If further information is desired, we would be pleased to have you let us know.

Sincerely yours,

FREDERICK J. BRADY,
Acting Director, Office of Public Health.

Current research projects, International Cooperation Administration—Total number of projects, 7; dollar volume, $927,233

Principal categories of projects in biomedical research	Number of projects	Dollar volume
(*a*) Intramural	None	None
(*b*) Extramural:		
1. Vector control in worldwide malaria eradication program (CDC)	1	$140,000
2. Trials of antimalarials in human volunteers (NIH)	1	5,000
3. Cholera investigations (NIH)	1	90,733
4. Medical research (grant to World Health Organization)	1	500,000
5. Quantitative relationships between municipal water supplies and economic development (Northwestern University)	1	27,500
6. Relationships between health programs and economic benefits (Johns Hopkins University)	1	58,000
7. Study of trypanosomiasis in Liberia-American Foundation for Tropical Medicine	1	[1] 106,000

[1] Prorated costs of total 2½-year contract of $276,000.

FACTS REQUESTED

(*a*) The health projects which ICA is carrying out in cooperation with host countries deal primarily with training and demonstrations, and in the case of malaria eradication and the community water supply programs with specific operations. Even though research is necessarily an integral part of many of these projects, it is not readily identifiable apart from the activity. For this reason in addition to the one listed in (b) below, the Office of Public Health does not register its projects with the Bio-Sciences Information Exchange.

(*b*) In order for an agency to participate in the services provided by the Bio-Sciences Information Exchange, it is necessary to contribute financially to the support of the Exchange. The Office of Public Health has not recommended financial support for this type of activity since the number of research projects has not been large, and more urgent needs have been found for the use of funds allocated for health programs.

(*c*) Because of the small number of research projects, we do not propose to reuqest funds for the support of the Bio-Sciences Information Exchange.

(*d*) The type of inquiries received by the Office of Public Health have not been of the type to be referred to the Bio-Sciences Information Exchange.

ICA'S AFFILIATIONS WITH OTHER AGENCIES IN INTERNATIONAL BIOMEDICAL RESEARCH

A. The following chart indicates the agencies with which the Office of Public Health of International Cooperation Administration shares principal interest in biomedical research. They are: (*1*) intergovernmental—World Health Organization; (*2*) U.S. Government—Department of Health, Education, and Welfare, Public Health Service: (a) Communicable Disease Center, (b) National Institutes of Health; (*3*) universities—(a) Johns Hopkins, (b) Northwestern; (*4*) philanthropic—American Foundation for Tropical Medicine.

Shown also are the specific subject areas of the research and the type of arrangement utilized in carrying out the biomedical research activity—contract, grant, agreement.

B. Coordination between ICA and the agencies listed in A (above) is brought about by a two-way flow of reports and correspondence, telephone conversations, appointment of special ICA committees to study specific aspects of the research projects, representation on governmental committees dealing with biomedical research.

C. ICA collaborates with foreign governments on certain aspects of research when they are related to the disease control projects being carried out cooperatively. These activities include comparing the methods available, altering and adapting techniques to fit particular situations, and in some cases advising the host government on its internal research needs.

ICA collaborates with other U.S. Government agencies through joint planning and ICA financing of research projects. Further, ICA evaluates and reviews researches performed by other agencies through representation on committees dealing with subjects of concern to ICA.

International Cooperation Administration Affiliation with Other Agencies in International Biomedical Research

FY '60

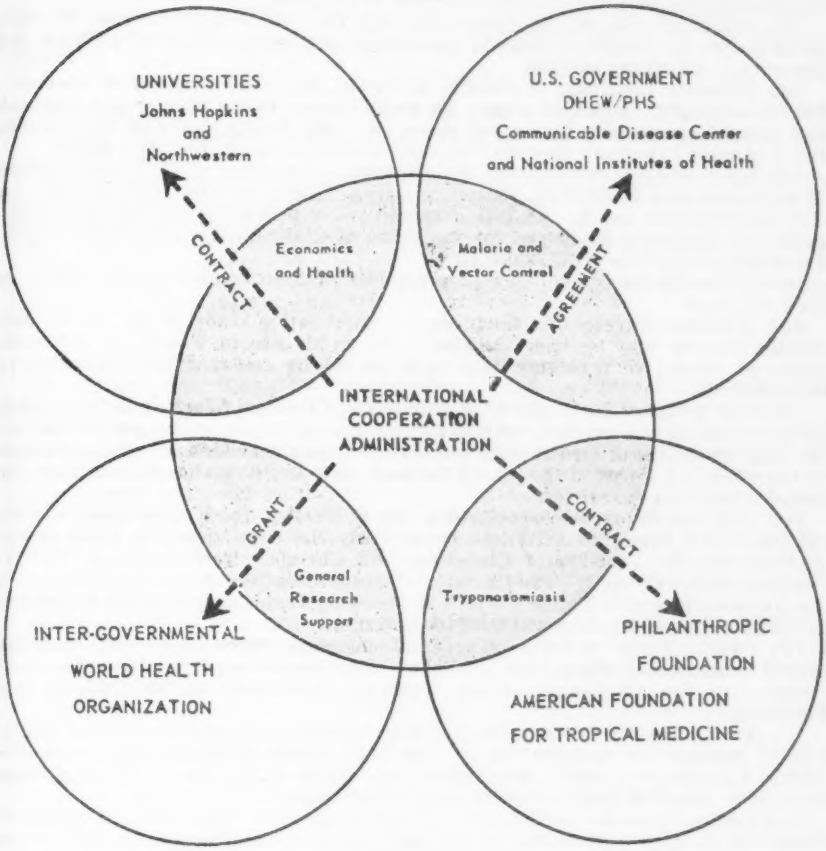

EXHIBIT 68

LETTER OF SEPTEMBER 21, 1959, FROM CHEMICAL CORPS, DEPARTMENT OF THE ARMY, ON ITS WORKING RELATIONSHIPS WITH OTHER GOVERNMENTAL AGENCIES IN BIOMEDICAL RESEARCH

DEPARTMENT OF THE ARMY,
Washington, D.C., September 21, 1959.

DEAR MR. CHAIRMAN: This letter supplements my interim reply of September 3, 1959, to your recent inquiry concerning the extent of working relationships between Armed Forces research in biological, chemical, and radiological weaponry and other agencies' activity in basic and applied biomedical research.

In the area of your expressed interest, the U.S. Army Chemical Corps principal working relationships with other governmental agencies are indicated by the contracts described below:

(*a*) *U.S. Public Health Service.*—The Chemical Corps has maintained contracts with subordinate agencies of the U.S. Public Health Service for a number of years covering various research problems of chemical warfare and biological warfare. The following is a list of contracts currently in effect with agencies of the U.S. Public Health Service.

(1) Communicable Disease Center, Atlanta, Ga. Amount of contract: $20,000. Brief scope: To conduct field testing of arthropods of interest to the biological warfare research and development program.

(2) Robert A. Taft Sanitary Engineer Center, Cincinnati, Ohio. Amount of contract: $45,000. Brief scope: To determine the water pollution potential of wastes resulting from production of biological products.

(3) Communicable Disease Center, Atlanta, Ga. Amount of contract: $20,000. Brief scope: To conduct studies in the ecology and epidemiology of anthrax and the testing of anthrax vaccine.

(4) National Institutes of Health, Bethesda, Md. (*a*) Amount of contract: $50,000 annually. Brief of scope: To study the synthesis of nitrogen mustard and related compounds for cancer research. (*b*) Amount of contract: $3,000. Brief of scope: To study chemical warfare contamination of food and water.

(*b*) *Office of Civil and Defense Mobilization.*—The Office of Civil and Defense Mobilization has funded the Chemical Corps $87,000 for the development of a civilian protective mask. An infant protector for protecting infants from toxic agents is also being developed for the Office of Civil and Defense Mobilization. Funding for this item is $61,000.

In addition to the foregoing, representatives of the Chemical Corps engage in the following:

(*a*) *National Bureau of Standards.*—A cooperative study is in process concerning gamma and neutron shielding. No funds are involved. In the past, chemical protective problems have been solved by contract with the Bureau of Standards.

(*b*) *The National Institutes of Health.*—The Chemical Warfare Laboratories, Army Chemical Center, Md., maintains continuous liaison with members of the National Institutes of Health with respect to compounds which may be of interest to the Chemical Corps in the search for new toxic agents and new treatment for chemical warfare casualties.

(*c*) *National Research Council.*—Dr. Per K. Frolich, the Deputy Chief Chemical Officer for Scientific Activities, is currently the Department of Army representative on the Division of Chemistry and Chemical Technology of the National Research Council. The Chemical Corps maintains continuous liaison with the National Research Council, which is presently furnishing relevant statistical data of interest in the chemical warfare program.

(*d*) *Public Health Service.*—The chief chemical officer is serving, and has served continuously since 1955, as liaison representative of the Department of Defense to the Interdepartmental Advisory Committee on Community Air Pollution.

(*e*) *Atomic Energy Commission.*—In accomplishing the Chemical Corps' radiological mission, representatives of the U.S. Army Chemical Corps' Radiological Laboratory consult and confer with those of the Atomic Energy Commission in areas of health physics and radioisotopes.

It is realized that the above is only a brief description of the areas of Chemical Corps cooperation and liaison in the field of biomedical research, and if you desire more detailed information on any or all of the indicated relationships, every effort will be made to furnish the data desired.

Sincerely yours,

MARSHALL STUBBS, *Major General, USA,*
Chief Chemical Officer.

NOTE BY SENATOR HUMPHREY ON EXHIBIT 69

Chart Outlining Current Biomedical Research by Federal Agencies, Divisions, and Bureaus, Outside the National Institutes of Health

I regard the chart which follows as one of the subcommittee's most important single contributions in connection with this interagency subject. The chart brings together for the first time virtually the entire Governmentwide "story" at least in broad outline, so far as non-NIH biomedical research projects are concerned.

In looking through it, however, certain facts as regards the chart's background, preparation and limitations should be borne in mind.

All of the facts listed below depict why the chart can only be construed as being of an approximate and preliminary nature.

ORIGIN OF CHART

At or not long after the hearing of August 11, 1960, both the departments and agencies which attended and those which did not attend were notified that the subcommittee desired to draw up a chart of this nature.

We indicated to them that a chart-type format had been deliberately chosen. We feel that a chart offers strong advantages in enabling the lay reader rapidly to perceive the scope, complexity, and interrelationships of the various agencies' activities.

STRENGTH AND WEAKNESSES OF CHART

The conciseness of the data in chart form is, however, both a strength and weakness. The principal strength is, as noted, the easy accessibility of the data for rapid viewing.

The major weakness is that a chart cannot, unless it is to become cumbersome, include the large body of significant observations which the various agencies regard as necessary toward interpreting their respective data.

By contrast, for present purposes of brevity, only a few footnotes are shown in the chart.

The agencies' view on the desirability of detailed observations can be understood in the light of the following:

THE PROBLEM OF DEFINITION

(1) In the first place, the most difficult single problem which confronted many of the agencies is and was in defining what constitutes "biomedical research." The subcommittee hesitated to attempt to draw up a definitive definition because, while this appears on the surface to be a comparatively simple problem, it would actually involve a great many long-standing administrative and scientific problems within the Executive Branch. The National Science Foundation in sending questionnaires to the agencies for reporting Federal funds for science uses certain definitions at present and is constantly evolving refinements. As everyone realizes, the process of further developing standardized and improved nomenclature among the agencies cannot be carried out by fiat, but only by carefully worked-out agreement.

It will be noted in a future report by the subcommittee that the matter of definition of what is "biomedical" and what is "research" is one which should have the continued earnest attention of the departments and agencies toward the end of the fullest possible agreement.

The Congress, we believe, is entitled to receive data from the agencies which is as uniform as possible. The agencies themselves will benefit thereby.

(2) A further complication is and was determining what constitutes a "project." A work-unit of research in the Federal Government is not uniformly termed a "project." Other terminology which may be used is "tasks" and "subtasks."

In any event, statistics of "projects" are not fully meaningful in themselves because a "single" project, depending upon the agency and the program, may cost $1,000 or $500,000 (or still more in the case of physical sciences).

Nevertheless, for preliminary purposes of comparing the amount of work under support by agency A one year and the amount the next or previous year, statistics of projects and of their respective dollar volume totals can be helpful. (This is provided, of course, that the agency itself has been using self-consistent definitions.)

DIFFERENCES IN AGENCY RECORDKEEPING

(3) A number of Federal agencies do not maintain this type of information by project or task or similar breakdown at all. Therefore, it was particularly difficult for them to give us figures of estimated, much less, actual obligations by project category.

(4) Scanning of the chart will also show that our attempt to get a clear-cut division as between "intramural" and "extramural" research was not fully successful. Again, several agencies do not maintain their records in this way,, nor do they always agree as to what these terms mean. Their particular programs have evolved along different lines of administration, performance, and accounting.

(5) The shortage of time for development of the information was in a few instances critical. The subcommittee had to have the information in ample time for—

(*a*) Publication of this particular hearing volume;

(*b*) Careful subcommittee review of the volume as background to our preparation of the report which we are required to file by January 31, 1961.

Agencies which did not maintain their records in the way in which we requested the data were faced therefore with considerable difficulty in seeking to fulfill our need. There was no alternative on their part but to hazard rough estimates in several instances in order to comply with the deadline.

THE CHART AS A TOOL

In view of all the above, the chart should be construed as a working tool—as an initial draft, the best, perhaps, that could be obtained under the circumstances.

DATA IN SUBCOMMITTEE'S 1961 REPORT

It should be studied against the background of considerable additional review of agencies' research obligations which will be published in our final report. The latter information—which varies somewhat from data reported herein in that it is of a budgetary character—is being evaluated in conjunction with Mr. I. M. Labovitz, Senior Specialist, Legislative Reference Service, Library of Congress, formerly with the U.S. Bureau of the Budget.

GRAND TOTAL—NIH AND OTHERS

Finally, it should be noted that by adding the totals in the NIH chart (exhibit 9) and those within this chart, approximate grand totals for virtually the entire Federal Government appear as follows:

Total number of projects: 22,924.

Total dollar volume: $455,101,592.

The qualification, "virtually the entire" Federal Government is used, because there remain a small number of additional projects scattered in other agencies and not shown in the chart. This is the case in those agencies where research is an even smaller part of the program than in the instances shown in the chart.

COMPARISON WITH BSIE TOTAL

It will be noted that the above figure of 22,924 federally supported projects varies from a larger but somewhat less exact figure of 25,406, as registered with and reported by the Bio-Sciences Information Exchange (p. 113).

The subcommittee's current compilation as to 22,924 projects covers virtually all projects of a biomedical nature supported by the agencies. BSIE has carefully indicated that many projects are not reported to it; on those which are reported, the figures, based on a given point in time, "may include more than the awards in 1 fiscal year; they may lack grants terminated shortly before (and) for which additional awards have not come through, etc." Therefore, BSIE, with less actual coverage, has reported a larger figure—in view of reporting twice on some projects which are renewed in a particular fiscal year. The subcommittee's compilation of agencies' data, is by contrast, more likely to tally any given project only once.

ACKNOWLEDGMENT

The charts in exhibits 9 and 69 were drafted in accordance with our instructions and varityped under the general direction of the Office of Program Planning, NIH, by Mrs. Helen Kerr and her staff of the Medical Arts Section.

We acknowledge with thanks NIH's excellent cooperation in this helpful graphic work (as in so many other instances of substantive work).

We also are appreciative of the cooperation of the various agencies without whose help our staff could not have rapidly compiled this comprehensive data.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

TOTAL NO. OF PROJECTS 1,126
TOTAL DOLLAR VOLUME $30,299,000

PUBLIC HEALTH SERVICE
(other than National Institutes of Health)

Total No. of Projects 246
Total Dollar Volume $19,176,700

Category	No. of Projects	Dollar Volume
RESEARCH GRANTS		
Sanitary engineering	15	$ 450,000
Research in hospital services and administration	32	1,000,000
DIRECT RESEARCH		
Assistance to States in health of aged, chronic disease, occupational health, accident prevention	16	1,020,900
Clinical and laboratory research – control of venereal diseases	8	813,000
Cooperative applied research in control of tuberculosis	6	1,811,100
Communicable disease activities at Communicable Disease Center and Arctic Health Research Center	94	6,077,000
Research in air pollution, water pollution, radiological health, and milk and food	34	5,315,600
Research into improvement of hospitals	4	200,000
Nursing resources research	8	419,500
Public health methods and reports	29	2,069,600

OTHER THAN PUBLIC HEALTH SERV

Total No. of Projects 880
Total Dollar Volume $11,122,300

Category	No. of Projects
SOCIAL SECURITY ADMINISTRATION	
Research Grants	
Maternal and child health research	5
Crippled children's research	5
Direct Research	
Children's Bureau research – Salaries and expenses	
OFFICE OF EDUCATION	
Cooperative research	271
OFFICE OF VOCATIONAL REHABILITATION	
Research and demonstrations	225
FOOD AND DRUG ADMINISTRATION	

	Intramural	Extramu
Total No. of Projects	365	9
Total Dollar Volume	$884,000	$38,300

Category	No. of Projects
Clinical investigation of drugs for human use	24
Clinical investigation of veterinary drugs	26
Clinical investigation of therapeutic devices	4
Nutrition studies	22

EXHIBIT 69

BIO-MEDICAL RESEARCH SUPPORTED BY FEDERAL AGENCIES OUTS
1960 FISCAL YEAR

TOTAL NO. OF PROJECTS . . . . . .
TOTAL DOLLAR VOLUME . . . . . .

TH SERVICE

No. of Projects	Dollar Volume
5	$ 160,000
5	240,000
	100,000
271	3,200,000
225	6,500,000

Extramural
9
$38,300

No. of Projects	Dollar Volume
24	$ 52,700
26	84,000
4	8,300
22	48,900

FEDERAL AVIATION AGENCY

TOTAL NO. OF PROJECTS . . . . . 11 (Estimated)
TOTAL DOLLAR VOLUME $930,039

Category	No. of Projects	Dollar Volume
Extramural		
Age as it influences human health and capabilities in civil aviation activities	1	$ 26,785
Safe mass transport of unselected passengers derived from the general population	2	90,488
Human factor aspects of civil aviation accidents	1	14,950
Medical techniques suitable for efficient screening and evaluation of civil aviation personnel throughout the general population	4	74,771
Biological stress problems unique to civil aviation (duration of flight, toxic hazards, disturbance of diurnal cycle associated with aviation activities)	2	5,000
Medical study and planning for forthcoming civil aviation vehicles and supporting equipment	1	35,945
Total	11	$247,939
Intramural		$682,100

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

TOTAL NO. OF PROJECTS 11
TOTAL DOLLAR VOLUME $1,853,850

Category	No. of Projects	Dollar Volume
Life sciences support for Project Mercury	1	$984,700
Flight medicine and biology	6	566,045
Basic medical and behavorial sciences	2	85,500

DE

TOTAL NO. OF PROJE
TOTAL DOLLAR VOLU

Total dollar volume f
Total dollar volume f

DOD COMBINED BIOME

Category

Biology and physiology
Aerospace medicine and
Submarine and shipboard
Military and field medic
Nuclear medicine
Military occupational an
medicine
Clinical medical resear
Noise control/conserva
BW and CW research
Neurophysiology and ne
Non-health-related biol
Miscellaneous †

* These are officially li
† For scientific advisor

INTERNATIO

TOTAL NO. OF PROJ
TOTAL DOLLAR VOL

EXHIBIT 69

Y FEDERAL AGENCIES OUTSIDE THE NATIONAL INSTITUTES OF HEALTH
1960 FISCAL YEAR

. . . . . 10,859 (Estimated)
. . . . . $194,415,822 (Estimated)

Dollar
Volume
26,785
90,488
14,950
74,771
5,000
35,945
247,939
582,100

ON
ollar
olume
84,700
66,045

DEPARTMENT OF DEFENSE

TOTAL NO. OF PROJECTS* 99
TOTAL DOLLAR VOLUME $48,626,000

Total dollar volume for intramural program . . . $27,104,000
Total dollar volume for extramural program . . . $21,522,000

DOD COMBINED BIOMEDICAL R&D PROGRAM BY MAJOR CATEGORIES

Category	No. of Projects	Dollar Volume
Biology and physiology	23	$11,207,000
Aerospace medicine and biology	9	7,384,000
Submarine and shipboard medicine	2	565,000
Military and field medicine	10	2,705,000
Nuclear medicine	7	4,755,000
Military occupational and preventive medicine	18	4,851,000
Clinical medical research	8	4,148,000
Noise control/conservation of hearing	2	320,000
BW and CW research	11	10,706,000
Neurophysiology and neurology	2	849,000
Non-health-related biological research	4	680000
Miscellaneous †	3	456000

* These are officially listed budget line items

† For scientific advisory services

U. S. DEPARTMENT (

RESEARCH PROGRAMS R
"DIRECT IMPACT ON M
AGRICULTURAL RESEARCH SERVICE, A
AND FOREST

TOTAL NO. OF PROJECTS . . . . . .
TOTAL DOLLAR VOLUME . . . . . .

Category

Veterinary medicine
Mammalian nutrition
Food composition
Food consumption and dietary levels
Insects affecting man and animals
Toxicology and pharmacology
Drug plants
Allergens
Radioactive materials – removal from foo

Of the total estimated allocations, appro
(42%) are for extramural research at 68 l
locations for intramural research.

INTERNATIONAL COOPERATION ADMINISTRATION

TOTAL NO. OF PROJECTS 7
TOTAL DOLLAR VOLUME $927,233

No. of Doll

DEPARTMENT OF
BUREAU OF SPORT FISHER
FISH AND WILDLIF

TOTAL NO. OF PROJECTS . . . . . .
TOTAL DOLLAR VOLUME . . . . . .

TMENT OF AGRICULTURE

GRAMS REGARDED AS HAVING
ACT ON MEDICAL SCIENCE"
RVICE, AGRICULTURAL MARKETING SERVICE
FOREST SERVICE

. 912
. . . . . $16,120,000

	Number of Projects		
	Intra-mural	Extra-mural	Estimated Allocations
	129	276	$9,000,000
	102	224	3,450,000
	9	41	690,000
levels	8	5	305,000
als	25	2	810,000
	19	53	1,480,000
	7	8	240,000
	2	1	120,000
l from food	1	—	25,000
	302	610	$16,120,000

ons, approximately $3,860,000 (24%) and 147 man-years
ch at 68 locations or institutions. There are 103
ch.

ENT OF INTERIOR
FISHERIES AND WILDLIFE
WILDLIFE SERVICE

. . . . . 173*
. . . . . $697,700

VETERANS' ADMINISTRATION

TOTAL NO. OF PROJECTS 6,569
TOTAL DOLLAR VOLUME $17,349,000

Category	No. of Projects	Dollars Obligated
Infectious diseases – tuberculosis, all forms	317	$1,125,000
Cancer and allied diseases	441	1,859,000
Methods and techniques – Radiology and x-ray	57	
Allergic, endocrine, metabolic and nutritional disorders	738	1,879,000
Diseases of the blood and blood-forming organs	336	3,671,000
Heart and vascular diseases	707	
Mental psychoneurotic and behavioral disorders	1393	1,958,000
Nervous system and sense organ diseases	476	616,000
Respiratory diseases, except tuberculosis	329	764,000
Dental disorders	100	118,000
Infectious diseases, etc.	235	5,359,000
Digestive tract diseases, except dental	417	
Genitourinary diseases	184	
Skin and cellular tissue diseases	84	
Bone and joint diseases	123	
Methods and techniques:		
Anesthesia	34	
Surgery, not elsewhere classified	114	
Toxicity and poisoning	11	
All other, except radioisotopes	218	
Radioisotopes, not elsewhere classified	185	
Preclinical	70	

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

TOTAL NO. OF PROJECTS 1,126
TOTAL DOLLAR VOLUME $30,299,000

PUBLIC HEALTH SERVICE
(other than National Institutes of Health)

Total No. of Projects 246
Total Dollar Volume $19,176,700

Category	No. of Projects	Dollar Volume
RESEARCH GRANTS		
Sanitary engineering	15	$ 450,000
Research in hospital services and administration	32	1,000,000
DIRECT RESEARCH		
Assistance to States in health of aged, chronic disease, occupational health, accident prevention	16	1,020,900
Clinical and laboratory research – control of venereal diseases	8	813,000
Cooperative applied research in control of tuberculosis	6	1,811,100
Communicable disease activities at Communicable Disease Center and Arctic Health Research Center	94	6,077,000
Research in air pollution, water pollution, radiological health, and milk and food	34	5,315,600
Research into improvement of hospitals	4	200,000
Nursing resources research	8	419,500
Public health methods and reports	29	2,069,600

OTHER THAN PUBLIC HEAL

Total No. of Projects 880
Total Dollar Volume $11,122,300

Category

SOCIAL SECURITY ADMINISTRATION
- Research Grants
  - Maternal and child health research
  - Crippled children's research
- Direct Research
  - Children's Bureau research – Salaries and expenses

OFFICE OF EDUCATION
- Cooperative research

OFFICE OF VOCATIONAL REHABILITATION
- Research and demonstrations

FOOD AND DRUG ADMINISTRATION

Category	Intramural
Total No. of Projects	365
Total Dollar Volume	$884,000

Category

- Clinical investigation of drugs for human use
- Clinical investigation of veterinary drugs
- Clinical investigation of therapeutic devices
- Nutrition studies
- Investigation of adverse reactions from drugs
- The development of biological methods for examination of foods, drugs, therapeutic devices and cosmetics
- Studies on the toxic effects of substances, including pesticides, colors and other chemicals added or proposed to be added to foods, drugs and cosmetics
- The development of biomedical data necessary for the effective enforcement of the Federal Food, Drug and Cosmetic Act, not included in previous categories

Total

ATOMIC ENERGY COMMISSION

TOTAL NO. OF PROJECTS . . . . . 1,060 (Estimated)
TOTAL DOLLAR VOLUME . . . . . $53,200,000 (Estimated)

Radiation biology	$18,200,000
Radiation genetics	3,300,000
Environmental radiation	7,200,000
Radiation toxicology	4,500,000
Radiation protection	4,100,000
Agriculture	1,160,000
Medical applications	6,200,000
Radiation instruments	3,600,000
Education training	3,900,000
Administration	1,040,000

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LIC HEALTH SERVICE

80
22,300

	No. of Projects	Dollar Volume
N		
rch	5	$ 160,000
	5	240,000
		100,000
	271	3,200,000
	225	6,500,000

mural	Extramural
5	9
000	$38,300

	No. of Projects	Dollar Volume
	24	$ 52,700
ugs	26	84,000
	4	8,300
	22	48,900
n		
	23	125,800
s for eutic		
	48	258,500
nces, her added		
	210	251,500
ec- t of tic gories	17	92,600
tal	374	922,300

TOTAL NO. OF PROJECTS . . . . . 11 (Estimated)
TOTAL DOLLAR VOLUME $930,039

Category	No. of Projects	Dollar Volume
Extramural		
Age as it influences human health and capabilities in civil aviation activities	1	$ 26,785
Safe mass transport of unselected passengers derived from the general population	2	90,488
Human factor aspects of civil aviation accidents	1	14,950
Medical techniques suitable for efficient screening and evaluation of civil aviation personnel throughout the general population	4	74,771
Biological stress problems unique to civil aviation (duration of flight, toxic hazards, disturbance of diurnal cycle associated with aviation activities)	2	5,000
Medical study and planning for forthcoming civil aviation vehicles and supporting equipment	1	35,945
Total	11	$247,939
Intramural		$682,100

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

TOTAL NO. OF PROJECTS 11
TOTAL DOLLAR VOLUME $1,853,850

Category	No. of Projects	Dollar Volume
Life sciences support for Project Mercury	1	$984,700
Flight medicine and biology	6	566,045
Basic medical and behavorial sciences	2	85,500
Space biology	2	217,605

NATIONAL SCIENCE FOUNDATION

TOTAL NO. OF PROJECTS 891
TOTAL DOLLAR VOLUME $24,413,000

Category	No. of Projects	Dollars Obligated
Developmental biology	65	$1,684,000
Environmental biology	129	2,539,000
Genetics	74	2,100,000
Metabolic biology	116	3,027,000
Molecular biology	116	5,444,000
Psychobiology	83	2,124,000
Regulatory biology	121	3,516,000
Systematic biology	149	2,710,000
General	38	1,269,000

TOTAL NO.
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DOD COMBI

Category

Biology and
Aerospace
Submarine a
Military and
Nuclear me
Military occ
medicine
Clinical me
Noise contr
BW and CW
Neurophysi
Non-health-
Miscellane

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TOTAL N
TOTAL D

Category

Extramura
Vector co
eradica
Trials of
volunte
Cholera in
Medical r
Health
Quantitati
munici
econo
Univer
Relations
and ec
Univer
Study of
Ameri
Medici
Intramura

* Prorate

DEPARTMENT OF DEFENSE

TOTAL NO. OF PROJECTS* 99
TOTAL DOLLAR VOLUME $48,626,000

Total dollar volume for intramural program . . . $27,104,000
Total dollar volume for extramural program . . . $21,522,000

DOD COMBINED BIOMEDICAL R&D PROGRAM BY MAJOR CATEGORIES

Category	No. of Projects	Dollar Volume
Biology and physiology	23	$11,207,000
Aerospace medicine and biology	9	7,384,000
Submarine and shipboard medicine	2	565,000
Military and field medicine	10	2,705,000
Nuclear medicine	7	4,755,000
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Clinical medical research	8	4,148,000
Noise control/conservation of hearing	2	320,000
BW and CW research	11	10,706,000
Neurophysiology and neurology	2	849,000
Non-health-related biological research	4	680,000
Miscellaneous †	3	456,000

* These are officially listed budget line items

† For scientific advisory services

U. S. DEPARTMENT OF A

RESEARCH PROGRAMS REGA
"DIRECT IMPACT ON MEDI
AGRICULTURAL RESEARCH SERVICE, AGRI
AND FOREST SER

TOTAL NO. OF PROJECTS . . . . . .
TOTAL DOLLAR VOLUME . . . . . .

Category
Veterinary medicine
Mammalian nutrition
Food composition
Food consumption and dietary levels
Insects affecting man and animals
Toxicology and pharmacology
Drug plants
Allergens
Radioactive materials – removal from food

Of the total estimated allocations, approxima
(42%) are for extramural research at 68 locati
locations for intramural research.

INTERNATIONAL COOPERATION ADMINISTRATION

TOTAL NO. OF PROJECTS 7
TOTAL DOLLAR VOLUME $927,233

Category	No. of Projects	Dollar Volume
Extramural		
Vector control in worldwide malaria eradication program (CDC)	1	$140,000
Trials of antimalarials in human volunteers (NIH)	1	5,000
Cholera investigations (NIH)	1	90,733
Medical research (grant to World Health Organization)	1	500,000
Quantitative relationships between municipal water supplies and economic development (Northwestern University)	1	27,500
Relationships between health programs and economic benefits (Johns Hopkins University)	1	58,000
Study of trypanosomiasis in Liberia-American Foundation for Tropical Medicine	1	106,000*
Intramural	None	None

* Prorated costs of total 2½-year contract of $276,000

DEPARTMENT OF INT
BUREAU OF SPORT FISHERIES
FISH AND WILDLIFE SE

TOTAL NO. OF PROJECTS 1
TOTAL DOLLAR VOLUME $6

Category
EXTRAMURAL
Waterfowl management
Pesticide – wildlife relationships*
INTRAMURAL
Wildlife
Pesticide – wildlife relationships*
Diseases and parasites
Fishery
Fish pathology
Fish nutrition
Fish – pesticide research

* Does not include field studies of wildlife popu
following pesticidal applications. Total pesti
research program involves 32 projects at cost

† Involves method of controlling mosquitoes with
marsh values.

...S REGARDED AS HAVING
...ON MEDICAL SCIENCE"
...E, AGRICULTURAL MARKETING SERVICE
...EST SERVICE

..... 912
..... $16,120,000

	Number of Projects		
	Intra-mural	Extra-mural	Estimated Allocations
	129	276	$9,000,000
	102	224	3,450,000
	9	41	690,000
s	8	5	305,000
	25	2	810,000
	19	53	1,480,000
	7	8	240,000
	2	1	120,000
n food	1	—	25,000
	302	610	$16,120,000

...pproximately $3,860,000 (24%) and 147 man-years
... 68 locations or institutions. There are 103

... OF INTERIOR
...HERIES AND WILDLIFE
...LIFE SERVICE

.... 173*
.... $697,700

	No. of Projects	Dollar Volume
	1†	$ 4,500
	2	6,200
	11	90,000
	19	139,000
	52	191,000
	73	205,000
	15	62,000

...dlife population changes
...otal pesticide – wildlife
...s at cost of $185,000.
...itoes without destroying

TOTAL NO. OF PROJECTS 6,569
TOTAL DOLLAR VOLUME $17,349,000

Category	No. of Projects	Dollars Obligated
Infectious diseases – tuberculosis, all forms	317	$1,125,000
Cancer and allied diseases	441	1,859,000
Methods and techniques – Radiology and x-ray	57	
Allergic, endocrine, metabolic and nutritional disorders	738	1,879,000
Diseases of the blood and blood-forming organs	336	3,671,000
Heart and vascular diseases	707	
Mental psychoneurotic and behavioral disorders	1393	1,958,000
Nervous system and sense organ diseases	476	616,000
Respiratory diseases, except tuberculosis	329	764,000
Dental disorders	100	118,000
Infectious diseases, etc.	235	5,359,000
Digestive tract diseases, except dental	417	
Genitourinary diseases	184	
Skin and cellular tissue diseases	84	
Bone and joint diseases	123	
Methods and techniques:		
Anesthesia	34	
Surgery, not elsewhere classified	114	
Toxicity and poisoning	11	
All other, except radioisotopes	218	
Radioisotopes, not elsewhere classified	185	
Preclinical	70	

BACKGROUND ON CHART

This chart is a preliminary draft. It was prepared for the use of the Subcommittee on Reorganization and International Organizations, Senate Committee on Government Operations. It was designed to be published in connection with the Hearing on Inter-Agency Coordination of Activities in Biomedical Research.

The Chart contains data for the 1960 fiscal year. But since the Subcommittee Hearing took place only a little more than a month after the end of the fiscal year, it is understandable that complete figures were not available from the respective agencies in several instances.

In particular, all agencies were not in a position to provide immediate breakdowns of intramural and extramural totals nor to give actual, rather than estimated, obligations. Data are not uniform in other respects as well because of the relatively brief period available for compilation. Despite these and other limitations, the chart is believed to represent one of the most comprehensive summaries on this subject ever available to the Congress. The Chart is printed not as definitive outline, but rather as an initial effort, which may be useful at this particular stage in viewing Federal biomedical research from a broad perspective.

APPENDIX A

STAFF MEMORANDUM ON FINDINGS OF HOOVER COMMISSIONS BEARING UPON PROBLEM OF INTERAGENCY COORDINATION OF BIOMEDICAL RESEARCH [1]

OUTLINE OF MEMORANDUM

EARLIER STUDIES BY THE TWO HOOVER COMMISSIONS BEARING UPON THE PRESENT SENATE STUDY (INCLUDING ITS REVIEW OF INTERNATIONAL HEALTH)

A. Background—the subcommittee's approach in reviewing relevant documents:
1. Jurisdiction of committee as regards reorganization.
2. Jurisdiction as regards economy and efficiency.
3. Matters beyond committee's purview.
4. Limited findings of Hoover Commissions on international phase.
5. Relevance of Hoover findings on domestic activity to international phase.
6. Caution in appraising excerpts from diverse Hoover reports.

B. Summary of basic findings by the Hoover Commissions:
1. Stress on coordination by First Hoover Commission.
2. Stress on coordination by Second Hoover Commission.
3. Lack of subsequent agency action on coordination.
4. An additional matter for others' review—the Federal hospital system and medical research.
5. Preface to detailed chronology.

C. Detailed findings by the First Hoover Commission:
1. Findings by the Brookings Institution.
2. Report of committee on Federal medical services.
   (*a*) Suggestion for interagency coordination.
   (*b*) Suggestion for increased research.
3. Final report.
4. Suggestion for coordination of scientific research.

D. Detailed findings by the Second Hoover Commission:
1. Report of task force: (*a*) Cautions on judging research.
2. Report on medical services:
   (*a*) Reasons for proposed Federal Advisory Council on Health.
   (b) Comments on Food and Drug Administration and Department of Agriculture.
3. Committee's previous findings on inaction on certain recommendations of Second Hoover Commission.

A. BACKGROUND—THE SUBCOMMITTEE'S APPROACH IN REVIEWING RELEVANT DOCUMENTS

The very first step taken by this subcommittee in its study was to examine pertinent literature. This included past Congressional hearings and reports, annual reports of Federal agencies and departments together with other executive branch documents, as well as books, magazine articles, monographs, and other background materials.

Inevitably, the subcommittee turned to one particular set of documents—those issued by and about the two Hoover Commissions on Organization of the Executive Branch of the Government.

The authority and competence of these two historic commissions, in expertly commenting on medical research or on other technical phases of Federal activity, are recognized throughout our Nation. While honest differences inevitably attended the policy findings of both commissions, the subcommittee felt that so far

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[1] A statement of background to this exhibit will be found on pp. 194–194.

as medical research and assistance might be concerned, few more significant guides could be presumed to exist than might be offered by these two commissions.

Why we turned to the Hoover Commission reports will be apparent, too, in the light of the following facts.

1. Jurisdiction of committee as regards reorganization

Rule XXV of the Standing Rules of the Senate provides that the Senate Committee on Government Operations shall, among other activities consider: "all proposed legislation, messages, petitions, memorials, and other matters relating to the following subjects: (A) budgeting and accounting measures, other than appropriations; (B) reorganization in the executive branch of the Government * * *."

Accordingly, it is to this committee that there has been referred legislation relating to the findings and recommendations of the two Commissions on Organization of the Executive Branch of Government which had been headed by former President Herbert Hoover.

To a larger extent than any other group, this committee has followed up on the work of these two Commissions.

The chairman of the Committee on Government Operations, the Honorable John L. McClellan, personally served, it should be noted, on both the First and Second Hoover Commissions.

He was and is therefore in an advantageous position to evaluate those results of the Commissions' work, which are pertinent to this study. That is true, as well, of expert members of the professional staff.

This committee has, as a whole, considered more Hoover Commission bills than any other committee of the Congress.

It is understandable, therefore, why the Subcommittee on Reorganization and International Organizations would have turned at the very outset of its study to an examination of (*a*) the record of pertinent findings by the two Hoover Commissions, and (*b*) to the facts as regards subsequent action or inaction on these findings and recommendations.

2. Jurisdiction as regards economy and efficiency

It is still more understandable in the light of the facts that (*a*) rule XXV requires this committee's attention to Federal economy and efficiency; and (*b*) both Hoover Commissions reported on "lack of coordination and * * * huge wastes in Federal medical services." (1)

3. Matters beyond committee's purview

Let it be clearly noted that the subcommittee does not purport to examine all of the many medical findings of the Hoover Commissions. Those findings were too complex, too technical, too vast, and, most important, too extensive beyond our present scope to be reviewed, much less followed up in our present limited study.

But neither could the subcommittee ignore the valuable insight afforded by the commissions on those limited phases which are definitely within our present scope.

The subcommittee cannot too strongly stress that the legislative and executive branches will find in this instance, as in others, that the outstanding assemblies of scientists and laymen who served with and on both commissions provided vital yardsticks for current guidance.

These reports gave the subcommittee, in effect, many helpful clues, many leads, many pointers which could hardly be overestimated as regards helpfulness.

4. Limited findings of Hoover Commissions on international phase

It should be noted that only limited comments were made by both the Hoover Commissions as regards the international phase, as such, of health (which is the subcommittees' focus under its original resolution S. Res. 347, 85th Cong.).

1. First, as to medical research, the international phase had actually not developed to a significant enough degree even as late as 1955 to be singled out by the Second, much less the First, Hoover Commission.

2. On the phase of international medical assistance, the First Hoover Commission documented certain Federal activities in international health as of 1949. The world health phase was, however, still so comparatively limited that the commission did not make specific and detailed recommendations. Its historical summary of the growth of America's interest in health overseas was, however, very useful.

5. Relevance of Hoover findings on domestic activity to international phase

Returning to medical research, the remarks by both Commissions on domestic research activity by Federal agencies are extremely pertinent to the international focus of our original study.

Proof of this relevance is clear. As the executive branch has constantly testified, the oversea phase of agencies' research is but an extension of their domestic operations. Oversea work is designed to fulfill their domestic responsibilities. The oversea phase constitutes even at this date but a small fraction of their domestic volume of work and expenditures.

For all of these reasons and others, what the Hoover Commission said about research activity at home is highly useful for our present purpose.

6. Caution in appraising excerpts from diverse Hoover reports

The reports of both Hoover Commissions should be read in entirety as regards the field of health if they are to be properly understood.

It is difficult to cull excerpts without bringing in considerable material which is extraneous for our purposes.

Nevertheless we have tried to extract the most relevant material, to report it within accurate context and yet not to encumber it with such other detailed information as might obscure the principal points within our own focus.

B. SUMMARY OF BASIC FINDINGS BY THE HOOVER COMMISSIONS

Among the important themes pertaining to medical research which recur in the reports to and by the two Hoover Commissions are the need for:

(*a*) scientific freedom for research, and yet

(*b*) improved efforts toward interagency coordination of research.

This memorandum will highlight quotations bearing upon (*b*) coordination since it is the interagency phase, rather than intra-agency administration which is of deepest significance under our legislative authority.

1. Stress on coordination by First Hoover Commission

In 1948, a report prepared by the Brookings Institution for the Committee on Medical Care of the First Hoover Commission suggested the need for an interagency committee or secretariat which would, among other things, "plan research and programs based on such research in areas yet untouched by present health activities."(2)

In 1949, the Committee on Federal Medical Services stressed in its report: "* * * some coordinating mechanism is needed under which research activities truly vital to national welfare may be considered."(3)

It continued:

"1. We recommend the establishment of a * * * Committee on Medical Sciences for the continuing study and coordination of medical research activities of the nonmilitary Federal agencies, consisting of representatives of the Division of Research and Training of the new bureau (of National Health—ed.), of the Atomic Energy Commission, and of the Department of Agriculture.

"2. We recommend that representatives of this new committee, together with those of the Committee on Medical Sciences of the Research and Development Board, be appointed to a new Interagency Committee on Medical Sciences to review the broad programs of all Federal agencies as a whole."(4)

The report specifically suggested that in a proposed new National Bureau of Health, there be created a Division of Research and Training which would: "include among its activities direct conduct of laboratory and basic research, administration of grants-in-aid programs, and maintenance of a clearinghouse for research information. Behind these functions should lie an overall responsibility for planning an integrated research program for the Bureau with the advice and recommendations of the operating divisions." (5)

The report elaborated on the clearinghouse function as follows: "The clearinghouse function would have essentially two parts: (1) Collection and dissemination of information about and emanating from various research projects, whether or not they are under Federal aegis; and (2) maintenance of a Nationwide inventory of medical research and facilities by location, type, and sponsorship." (6)

2. Stress on coordination by Second Hoover Commission

In 1955, the Task Force on Federal Medical Services recommended establishment of a Federal Council on Health. It commented:

"* * * the task force feels that the Federal Council on Health could outline areas where research is needed and on occasion be a place of useful and economical clearance of information on medical research programs planned or in force in different agencies of the Federal Government." (7)

The commission, in its own final report, commented with regard to the diverse expenditures on research by various Federal agencies:

"These expenditures lack overall planning, and there is no one agency which has the responsibility for such planning." (8)

The commission then recommended that:

"(a) * * * the proposed Federal Advisory Council of Health be given responsibility for reviewing the health research programs of the Federal Government; and the making of appropriate recommendations to the President." (9)

3. Lack of subsequent agency action on coordination

The fact that the Second Hoover Commission made recommendations for coordination confirmed that insufficient, if any, action toward that end had occurred in the intervening years.

Similarly, in the 5 years since the report of the second Hoover Commission, our own Committee on Government Operations has reported that there has been little, if any, action on setting up an interagency mechanism for coordination in research.

4. An additional matter for others' review—The Federal hospital system and medical research

Both Hoover Commissions commented at great length on the vast Federal hospital system—Public Health Service hospitals, Veterans' Administration, Department of Defense, and other institutions.

The First Hoover Commission referred at one point to the virtually universally accepted concept of "research as an inseparable part of teaching and good medical care." (10)

It would not be feasible for this subcommittee to reiterate all that the two commissions stated as regards Federal hospitals in relation to Federal research, much less in relation to medical care itself.

Both commissions made many critical comments as to the alleged lack of coordination within and between segments of the Federal hospital system—a deficiency which may be presumed to affect in some ways their medical research, as well.

The subcommittee is not in a position to refer further to this interhospital problem. But it does note the problem's deep significance in terms of (*a*) the well-being of the considerable patient population (whose potential numbers include as many as 30 million Americans, according to the U.S. Bureau of the Budget); (*b*) financial costs; and (*c*) medical research yield.

The staff notes that the future of Federal biomedical research will in part depend on policies within and between Federal medical care institutions.

What these institutions do or do not do may in turn depend on the character of the administration of each segment of the Federal hospital system, on the policies adopted by the Congress and the executive branch as well as, most important, on the scientific skills within the system.

5. Preface to detailed chronology

We may now trace the chronology of the Hoover Commissions' findings and results in greater detail.

In doing so, we will reprint certain additional information (over and above findings on research per se) so as to convey to the reader a meaningful understanding of the context.

The staff stresses, however, that caution should be observed in appraising references to other than research. Such references have necessarily been selected to point up the research phase but are hardly complete in and of themselves and should be evaluated only in their full context.

C. DETAILED FINDINGS BY THE FIRST HOOVER COMMISSION

1. Findings by the Brookings Institution

On November 10, 1948, Harold G. Moulton, president, the Brookings Institution, conveyed to Chairman Hoover a 590-page report on welfare programs in the Federal Government. The report was prepared by a Brookings staff member in cooperation with the committee on medical care of the commission. The report was subsequently printed by the commission.

The report pointed to a general lack of coordination in Federal health activities. It suggested a means be devised for interagency cooperation as regards research and other phases.

"From this study, it is evident that at the present time there is no well-developed plan for coordinating the health activities within the Federal Government. (11)

* * * * * * *

"Therefore, the development of a committee organization, or secretariat, seems necessary if an efficient, integrated, overall health program is to be carried out. Such a committee system should necessarily (1) bring about mutual understanding between member agencies of their individual health programs; (2) correlate facts about their programs in a simple, comprehensive reporting system for the public information; (3) take action to prevent undue duplication and overlapping of programs; (4) plan research and programs based on such research in areas yet untouched by present health activities; and (5) give consideration to our international health obligations." (12)

2. Report of Committee on Federal Medical Services

Late in 1948, the Committee on Federal Medical Services filed with Chairman Hoover a report with recommendations on Federal medical services. The report commended the objective of Federally supported medical research and education:

"Funds invested in research and education at this time will not only return dividends in dollar savings in the future, but a still greater reward in health and productivity in the Nation." (13)

It urged understanding of these programs and an appreciation of the intrinsic needs of science:

"In research there is need for a certain looseness and flexibility of administrative control. By their very nature, research activities are directed at new solutions and are easily stultified by rigid controls.

"They must have a large measure of autonomy if effective, imaginative work is to be done. A certain amount of duplication here is scientifically desirable. Such budgetary controls, coordination of effort, and broad planning as may be necessary to fulfill the responsibilities of the division, therefore, should not prejudice the maintenance of a large measure of autonomy at the level of the man with the ideas." (14)

Suggestion for interagency coordination.—But it pointed to the need for coordination:

"But some coordinating mechanism is needed under which research activities truly vital to national welfare may be considered. The Armed Forces have such a coordinating body in the recently appointed Committee on Medical Sciences of the Research and Development Board.

"1. We recommend the establishment of a similar Committee on Medical Sciences for the continuing study and coordination of medical research activities of the nonmilitary Federal agencies, consisting of representatives of the Division of Research and Training of the new Bureau, of the Atomic Energy Commission, and of the Department of Agriculture.

"2. We recommend that representatives of this new committee, together with those of the Committee on Medical Sciences of the Research and Development Board, be appointed to a new Interagency Committee on Medical Sciences to review the broad programs of all Federal agencies as a whole.

"The duties of the Interagency Committee on Medical Sciences should relate less to the intramural programs, where autonomy should be virtually complete,

than to the programs of contracts, grants-in-aid, and institutional grants to non-Federal institutions. The agency programs of the latter type must yield some measure of autonomy in favor of cooperation and coordination directed at insuring not only economy, but also the broad coverage which the entire Federal program must have.

"When the National Science Foundation shall have been established, the Interagency Committee should include representatives from the medical sciences unit of the Foundation." (15)

Suggestion for increased research.—The report urged greater Federal effort at control of disease through preventive measures:

"Control, then, is measured by high-grade medical service oriented toward preventive measures, research, and education." (16)

It pointed to what it regarded as a modest ratio between Federal funds spent for research and Federal funds spent for medical care:

"In the year 1948, over 85 percent of the Federal medical expenditures in the United States was for medical service—that is, the care of established disease among the Government's particular beneficiaries. Only 8.9 percent was spent for all projects related to public health and preventive medicine for the population as a whole, and but 3.9 percent for research.

"It is true that the total expenditures for research have been increased very considerably in the past decade, but comparison of relative amounts convinces us that the necessity for even greater expenditure has not been faced. Increases in expenditure for medical care are outstripping relatively those for control. The reverse should be the case." (17)

Final report.—The First Hoover Commission did not in its final report refer substantively to coordination of medical research, as such, except perhaps by implication, in terms of what it proposed as a "United Medical Administration."

Such a new agency was recommended be headed by an Administrator who would report directly to the President. The First Hoover Commisssion also recommended creation of:

"An Advisory Board to the Administrator consisting of the Surgeons General of the Army and Navy, the Air Surgeon and the Administrator of Veterans' Affairs." (18)

The proposal for a United Medical Administration, it should also be noted, envisioned, among other goals, consolidation of all the general hospitals of the Army, Navy, and Air Force, as well as the medical services and hospitals of the Veterans' Administration, and the hospitals of the Public Health Service.

It is not the purpose of the present study to examine at all the matter of domestic health services. Thus, it will not review the numerous ways in which the Department of Health, Education, and Welfare, as it ultimately emerged, differs from the United Medical Administration, as it was recommended.

It is sufficient for the moment to observe that the First Hoover Commission made no formal and explicit comment as regards interagency coordination of medical research, as such, in its final report.

Suggestion for coordination of scientific research.—It is interesting to note, however, that the First Hoover Commission did recommend under the miscellaneous category of recommendations:

"1. Create a National Research Foundation to coordinate the various science research programs of the Government." (19)

D. DETAILED FINDINGS BY THE SECOND HOOVER COMMISSION

1. Report of task force

In early 1955, the Task Force on Federal Medical Services transmitted a report to Chairman Hoover. In it, the issue of interagency coordination was once again raised and in more forceful terms than ever before.

The task force recommended establishment of a Federal Council on Health. It commented:

"* * *, the task force feels that the Federal Council on Health could outline areas where research is needed and on occasion be a place of useful and economical clearance of information on medical research programs planned or in force in different agencies of the Federal Government. Its role would, however, not be directing, operating, nor authoritatively controlling. It would be advisory. And in this advisory capacity it could well rely upon the National Research Council of the National Academy of Sciences for matters of fact and judgment concerning research carried on or aided by any branch of the Federal Government.

"In such terms of reference the Federal Council of Health would be expected to act on request from the President or his designated representative as a responsible critic of research programs in the general field of health that are carried on or supported by the National Science Foundation, the National Institutes of Health, the Veterans' Administration, the armed services or any other Federal agency engaged in medical research." (20)

Cautious on judging research.—The task force sounded a few notes of caution as regards supervision and appraisal of Federal medical research:

"Research involves an inquiring as distinct from an accepting attitude of mind. With the aid of exact observation it attempts to analyze a situation and then to construct hypotheses on premises that lend themselves to validation by experiment, in accord with the concepts of logic and with the aid of instruments and techniques of basic science. Common to most other good definitions and descriptions of research are references to the highly selective and unusual mind of the true research man. He is a rare event in nature. It is well to recognize him and help him: He cannot be made by routine educational expenditures. Indeed there are a freedom and an unpredictability in the workings of his mind that often elude, if they do not infuriate, the more routine minds of the teaching and the administrative groups around him. Helping an original mind resembles learning how to get a rare animal to breed in captivity. Certainly the right attitude toward research men and the task of facilitating their productivity has little to do with the practices of many employers, top sergeants, or animal trainers. We can afford to be humble about research men without being sentimental. This is a new task for Government." (21)

* * * * * * *

"Applying the inferences and conclusions that can be made regarding medical research from the experience of universities and civilian research institutes to the field of medical research maintained in part or in full by Federal funds, a few points become clearly evident. Our colleges and universities provide the only American source of highly trained recruits to the ranks of medical research. If their recruitment or their quality of teaching were to languish, Federal medical research would suffer within 1 to 6 years. It is not wise either to underfeed or kill the goose that lays the golden eggs: Starving her is easier as she loses the strength to squawk.

"Medical research men need easy contacts with the basic sciences, with clinicians, and with each other. Interchange, clearance of information and that delicate kind of supervision and coordination which prefers suggestions to orders and mutual respect rather than hierarchical authority—these are to be planned for and put into effect. (22)

* * * * * * *

"Intelligent evaluation of research or research programs cannot be exercised by persons unfamiliar with the fields of knowledge involved. (23)

* * * * * * *

"The furtherance of medical research offers many aspects that do not lend themselves to precise formulation in advance or ex cathedra." (24)

The task force stated its formal recommendation as follows:

"That the Federal Council of Health be given responsibility for facilitating the health research programs of the Federal Government, utilizing the National Research Council of the National Academy of Sciences as staff." (25)

2. Report on medical services

A few days later, the Second Hoover Commission formally filed its own report on medical services.

This report formally suggested creation of a Federal Advisory Council on Health.

By the preceding year 1954, the commission stated, Government contribution to medical research had risen to $119 million. The commission pointed out:

"Of the 1954 total, the Department of Health, Education, and Welfare expended $69 million, the Atomic Energy Commission, $26 million, the Department of Defense, $19 million, and the Veterans' Administration, $6 million. However, these expenditures lack overall planning, and there is no one agency which has the responsibility for such planning." (26)

Accordingly, the commission recommended:

"(*a*) That the proposed Federal Advisory Council of Health be given responsibility for reviewing the health research programs of the Federal Government; and the making of appropriate recommendations to the President." (27)

(*a*) *Reasons for proposed Federal Advisory Council on Health.*—It is interesting to note the context in which the Federal Advisory Council on Health was recommended as a whole.

Earlier in the report the commission noted:

"Our task force points out that there is no one point where Federal medical policies and activities can be reviewed in order to further coordination, eliminate duplication, and develop overall policies. There should be an agency within the Executive Office of the President charged with these responsibilities. There is at present in the Office of Defense Mobilization the Health Resources Advisory Committee, which serves also as Advisory Committee to the Selective Service System. It is proposed that these functions should be absorbed by a new Federal Advisory Council of Health.

"The functions of such a proposed Advisory Council might include:

"1. To make recommendations and continuous evaluation of policies and programs relating to Federal medical care and national health.

"2. To advise on measures for assuring adequate health manpower and hospital facilities for the Nation's health.

"3. To review proposals and programs and advise the President on all hospital construction involving Federal funds, including Federal grants.

"4. To advise upon coordination of regional hospital services of all agencies.

"5. To advise on more systematic cross-servicing between medical agencies.

"6. To advise upon measures for the adequate training and selection of medical staff of all Federal services.

"7. To advise the Federal departments on all medical policies and programs.

"8. To advise the Selective Service System on the mobilization of medical personnel.

"9. To advise upon systems of project grants for health research programs of the Federal Government.

"10. To report periodically on progress or failure in Federal health programs and policies to the President and the agencies concerned.

"11. To report to the President and advise the Budget Bureau and the Congress on such matters as they may request.

"The task force recommends that the Council should comprise eminent persons of distinguished competence in the health field as broadly defined, with limited terms and subject to rotation. The members should not be required to give full-time service, but be paid upon the usual per diem basis.

"Such a Council would be the beginning of the end of the present chaos. It would require a small staff of its own, but could call on the staffs of other agencies from time to time for special studies.

"Recommendation No. 1:

"In order to effect the above responsibilities, the President should appoint a Federal Advisory Council of Health, to be comprised of members of the medical professions together with lay members of distinguished records in fields other than the medical profession, and to serve at the will of the President. The Council should have a small staff, but should depend upon other agencies of the Government for information." (28)

(*b*) *Comments on Food and Drug Administration and Department of Agriculture.*—Another series of comments should also be noted at this point. The Commission observed with respect to the Food and Drug Administration and the Agriculture Service of the Department of Agriculture:

"Recommendation No. 19:

"That the President establish a joint committee representing the Department of Health, Education, and Welfare, the Department of Agriculture, and the Bureau of the Budget, with the advice of the Federal Advisory Council of Health, to make a detailed examination of the policies, programs, and operations of the Food and Drug Administration and the Agricultural Research Service in the Department of Agriculture, with a view of eliminating those activities no longer necessary under present conditions and eliminating conflicts and overlap between Departments." (29)

3. Committee's previous findings on inaction on certain recommendations of Second Hoover Commission

The outcome to date of the recommendations of the Second Hoover Commission has been described in the present, as in previous Congresses, by our own committee.

In early 1958, the Senate Committee on Government Operations filed with the Senate a 98-page report by its Subcommittee on Reorganization and International Organizations.

That report summarized in text and table the Congress' and executive branch's actions or lack of action on 25 specific suggestions of the Second Hoover Commission, relating to Federal medical services.

Four of the most pertinent of the medical recommendations were listed in the tables as not being implemented.

The subcommittee enumerated the four recommendations and their outcome as follows:

"1. In order to effect the above responsibilities, the President should appoint a Federal Advisory Council of Health, to be comprised of members of the medical professions together with lay members of distinguished records in fields other than the medical profession, and to serve at the will of the President. The council should have a small staff but should depend upon other agencies of the Government for information." (30)

Its outcome was described in a footnote as follows:

"Although the administration has accepted this recommendation as to objective, the Federal Advisory Council of Health has not been established to date. The recommendation is therefore carried in the nonimplemented category." (31)

Legislation had been introduced to set up an Advisory Council on Health. The Congress had not approved such legislation. One reason was that many members of the Congress, including Chairman McClellan and members of this committee, noted that there is and was ample authority for the President administratively to set up such a council.

It is believed that another reason was and is doubt among some members of the American medical profession and other citizens, as well as legislators, as to what the Advisory Council on Health might recommend as regards possible expansion of Federal activity.

A second recommendation was:

"19. That the President establish a joint committee representing the Department of Health, Education, and Welfare, the Department of Agriculture, and the Bureau of the Budget, with the advice of the Federal Advisory Council of Health, to make a detailed examination of the policies, programs, and operations of the Food and Drug Administration and the Agricultural Research Service in the Department of Agriculture, with a view of eliminating those activities no longer necessary under present conditions and eliminating conflicts and overlap between Departments." (32)

A footnote added: "Accepted partially or as to objective." (33)

A third recommendation was:

"25. (a) That the proposed Federal Advisory Council of Health be given responsibility for reviewing the health research programs of the Federal Government; and the making of appropriate recommendations to the President;" (34)

There was no implementation of this recommendation. (35)

A fourth and more detailed recommendation was:

"27. That the proposed Federal Advisory Council of Health examine means of establishing cooperating planning among Federal agencies providing psychiatric care; that the military services and the Veterans' Administration give greater emphasis to preventive psychiatric services; and that the Federal Government, through the Public Health Service, encourage more research and more training of psychiatrists and workers in allied fields." (36)

This recommendation was described as having been accepted but as not having begun to be implemented at that time. (37)

FOOTNOTES

(1) Commission on Organization of the Executive Branch of the Government, "Federal Medical Services—Report to the Congress," H. Doc. 99, 84th Cong., 1st sess., February 1955, p. 6.

(2) The Brookings Institution, "Functions and Activities of the National Government in the Field of Welfare—A Report With Recommendations Prepared for the Commission on Organization of the Executive Branch of the Government." Government Printing Office, Washington, D.C., Jan. 13, 1949, p. 48.

(3) Commission on Organization of the Executive Branch of the Government, "Federal Medical Services—A Report With Recommendations," by the Committee on Federal Medical Services, submitted Nov. 30, 1948, p. 68.

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(4) Ibid., pp. 68–69.
(5) Ibid., p. 69.
(6) Ibid., p. 71.
(7) Task Force on Federal Medical Services, "Report on Federal Medical Services," prepared for the Commission on Organization of the Executive Branch of the Government, Government Printing Office, Washington, D.C., February 1955, p. 21.
(8) Commission on Organization of the Executive Branch of the Government, "Federal Medical Services—A Report to the Congress," op. cit., p. 66.
(9) Ibid.
(10) Task Force on Federal Medical Services, op. cit., p. 70.
(11) The Brookings Institution, op. cit., p. 47.
(12) Ibid., p. 48.
(13) Commission on Organization of the Executive Branch of the Government, "Federal Medical Services—A Report With Recommendations," op. cit., p. 90.
(14) Ibid., p. 68.
(15) Ibid., pp. 68–69.
(16) Ibid., p. 90.
(17) Ibid.
(18) Chairman, Commission on Organization of the Executive Branch of the Government, "The 19th and Concluding Report of the Commission on Organization of the Executive Branch of the Government," H. Doc. 197, 81st Cong., 1st sess., p. 67.
(19) Ibid., p. 72.
(20) Task Force on Federal Medical Services, op. cit., pp. 21–22.
(21) Ibid., pp. 17, 19.
(22) Ibid., pp. 19–21.
(23) Ibid., p. 21.
(24) Ibid., p. 22.
(25) Ibid., p. 23.
(26) Commission on Organization of the Executive Branch of the Government, "Federal Medical Services—A Report to the Congress," op. cit., pp. 65–66.
(27) Ibid., p. 66.
(28) Ibid., pp. 21–22.
(29) Ibid., p. 56.
(30) Committee on Government Operations, U.S. Senate, report made by its Subcommittee on Reorganization, "Action by the Congress and the Executive Branch of the Government on the Second Hoover Commission Reports, 1955–57," p. 13.
(31) Ibid., p. 15.
(32) Ibid., p. 14.
(33) Ibid., p. 15.
(34) Ibid., p. 14.
(35) Ibid.
(36) Ibid., p. 15.
(37) Ibid., p. 15.

APPENDIX B[1]

CORRESPONDENCE OF JULY–AUGUST 1960 WITH NATIONAL INSTITUTES OF HEALTH ON INTRA-AGENCY AND INTERAGENCY PHASES OF INDEX-CONTROL SYSTEMS ON CURRENT RESEARCH PROJECTS

LETTER OF JULY 22, 1960 TO NATIONAL INSTITUTES OF HEALTH CONVEYING SUBCOMMITTEE INQUIRY ON INTRA- AND INTER-INSTITUTE INDEXING OF INFORMATION ON CURRENT RESEARCH PROJECTS

JULY 22, 1960.

Dr. JAMES A. SHANNON,
Director, National Institutes of Health,
Bethesda, Maryland

DEAR Dr. SHANNON: This will confirm and supplement phone requests conveyed by subcommittee staff to the Office of Research Planning.

As a part of our Government-wide survey of index-control systems, the subcommittee needs the following information for each of the respective Institutes as well as for the Division of General Medical Sciences:

(*a*) A descriptive summary of the nature of all the NIH index-control systems which cover current research projects—both intra-mural and extra-mural.

* * * * * * *

Under (*a*), as regards index-control systems—

(1) each description might briefly indicate significant similarities and dissimilarities with other Institute systems;

(2) a rough estimate should be made for each system of (*a*) the number of man-years involved in maintaining the system annually, (*b*) the total compensation involved, and (*c*) any other major, readily identifiable costs;

(3) the relationship between (*a*) the respective Institute systems and the coordinate index system should be indicated, (*b*) along with NIH systems' relationship with the Bio-Sciences Information Exchange index system.

(4) Finally, we would appreciate a statement on your part as to your general views on the administrative and scientific adequacy of the present NIH systems, particularly from the standpoint of oversight from your own office, and on the possibility of future use of electronic data processing methods.

Kindest regards.

Sincerely,

HUBERT H. HUMPHREY,
Subcommittee Chairman.

LETTER OF AUGUST 29, 1960, FROM NATIONAL INSTITUTES OF HEALTH ON INTRA- AND INTERINSTITUTE INDEXING OF INFORMATION ON CURRENT RESEARCH PROJECTS

NATIONAL INSTITUTES OF HEALTH,
Bethesda, Md., August 29, 1960.

DEAR MR. CHAIRMAN: As requested in your letter of July 22, each of the categorical Institutes and the Division of General Medical Sciences has prepared a summary description of its index-control system covering current research projects. A copy of these eight summaries are enclosed together with a description of the comprehensive index system centrally maintained by the Research Information Section of the Division of Research Grants. There is also a short memorandum on the preliminary work and future plans of the newly established Statistics and Analysis Branch of the Division of Research Grants.

Sincerely yours,

JAMES A. SHANNON, *Director.*

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[1] A statement of background to this exhibit—i.e., the need for strengthening intra-agency and interagency indexing systems and assuring optimum compatability may be found on pp. 50–51.

NATIONAL INSTITUTE OF ARTHRITIS AND METABOLIC DISEASES

SCIENTIFIC CLASSIFICATION ON NIAMD GRANTS AND MECHANICS OF MCBEE CARD SYSTEM

I. Classification

We have a unique problem in the National Institute of Arthritis and Metabolic Diseases in that in addition to specific areas of interest such as arthritis, diabetes, physical biology, gastronenterology, and cystic fibrosis we also support fundamental and clinical investigation in the general area of metabolism. This includes such diverse subjects as adrenal hormones, vitamins, amino acids, fats, carbohydrates, and minerals.

A member of the professional staff of NIAMD studies each of its applications in detail and determines which classification or classifications most accurately describes the scientific nature of the proposed work.

The project may deal with one of our specific areas of interest or it may be related to metabolism of a particular substance, metabolism by a particular organ or combinations thereof. A secondary classification also selected from the same list is frequently necessary in order to describe the full scope of the investigation.

However, there are serious limitations in the system now in use which make a refinement and an expansion necessary. There is a vast amount of useful information which we have not as yet been able to record.

Also, the efficiency of the mechanical process of retrieval needs to be improved to take care of the increased volume of projects with which we are dealing. In fiscal year 1956 the number of active grants totaled 473; in fiscal year 1960 the total had increased to 1,910. Studies are now underway to determine methods leading to improvement of the current system.

II. Mechanics of system

McBee card.—One card for each application received resulting in one card for each active grant (fiscal year 1960 total 1,910). The card is used for tenure of grant support as approved by the council.

Control card.—One card for each minor classification listing thereon each grant by number, and showing the project period and dollar amount for each year of support, subsequently annotated to indicate payment each year, or deletion of same. Control card is annotated at time of first payment to reflect future years of committed support, annotated after each council to reflect pending approvals, annotated to reflect project period extensions and/or related fiscal changes.

Since this control card is kept current with respect to fiscal and administrative data, at any given time, tabulations can be made which will reflect the financial support in number and dollar value of the grants awarded in any particular area of interest. Periodically, reports showing program support are prepared.

The McBee cards are maintained and filed in numerical sequence within each classification. These cards are punched to reflect grant data and status. They are annotated as necessary to contain specific information such as title of project, project periods, fiscal payments and commitments. Prior to council, cards are punched or annotated to allow for sorting for the following:

(1) Primary and second classifications—punched for both but filed under primary classification.
(2) Type of department.
(3) Council and council year.
(4) Study section.
(5) Type of application.
(6) Application number.
(7) State.
(8) Project title is determined and indicated.
(9) Study section recommendation is annotated.
(10) Priority is punched after study section meeting.
(11) Size of grant.

After council the action is recorded on the card.

At the time of award, the card is punched to reflect current fiscal year's payment, years of committed support, terminal year of support, and is annotated to show approved years of support.

At the time of termination, the card is punched to indicate termination. It is removed from active system and annotated accordingly.

The National Institute of Neurological Diseases and Blindness

DESCRIPTION OF INDEX CONTROL SYSTEM

The NINDB maintains two closely integrated index control systems. A program analysis unit is responsible for the statistical and administrative analysis of all grants to NINDB extramural program. This unit keeps records on all research grants (as well as training grants and fellowships); it catalogs them according to broad disease categories and scientific disciplines; and it maintains this information on McBee punchcards. Besides disease category classifications, various degrees of subclassification are established to permit immediate answers to specific questions relating to the grants program.

For each meeting of the National Advisory Neurological Diseases and Blindness (NANDB) Council, a program data book is prepared which lists current active research grants, cataloged according to disease category, scientific discipline, and type of research project, and gives an alphabetic listing of research personnel. The program data book also gives a breakdown of research grant support by fiscal year for the preceding 3 years and, in addition, shows an estimate of recommended support for the next fiscal year. Representative sheets from the program data book of April 1960 are appended.

To evaluate the productivity of the grant program, all publications reported by grantees and included in their progress reports are also indexed, with reference to subject matter and program interest.

From the above system it is possible to ascertain quickly the total amount of support in any major disease category or program and to obtain some indication of the effectiveness of the program in any particular area.

Although the other NIH Institutes maintain a similar system of subject classification of research projects supported through extramural programs, they do not, to our knowledge, compile a program data summary three times a year as does this Institute.

Four man-years are involved in maintaining this index control system at an estimated annual cost of $20,000.

Augmenting this statistical administrative report, a record is maintained of direct intramural research activity which the NINDB relates to the total national research effort. Moreover, the Office of the Director continuously surveys the field for new and promising areas of investigation deserving encouragement and development. To this end, the program analysis unit maintains an index that assists in the professional evaluation of the total national and international research effort. Using the same basic coding method in respect to broad disease categories, this index affords a detailed selective cross-referencing system to aid in analyzing current research according to (*a*) the application of scientific approaches, (*b*) the development of instrumentation, methods, and techniques, and (*c*) significant research progress and findings regarding etiology, pathology, classification, diagnosis, treatment, prevention, rehabilitation, and psychological aspects or consequences. Related legislative aspects are also included in the index.

Basic data for the index are obtained from notices received routinely from the Bio-Sciences Information Exchange, which constitutes the primary medium for integrating the NINDB extramural program with the total national research effort. However, information from this group is combined with information from scientific and nonscientific sources, including reports of conferences, visits to laboratories, and reviews of literature (when such data involve research not otherwise reported by Bio-Sciences Information Exchange).

As its objective, the program analysis unit maintains a current status report on research in any field within the purview of NINDB. This office is staffed by one public health analyst (GS–9) and one clerk-typist (GS–4), It involves 2 man-years at an annual cost of $11,000. No other readily identifiable major costs are attached to this unit.

Concerning the relationship of the index-control system to the coordinated index system and to the Bio-Sciences Information Exchange, each serves an important but somewhat different function. Particularly, the Bio-Sciences Information Exchange is one of our most important aids. Not only does it routinely supply notices of research projects, but in addition it has frequently provided this office with such notices on research within a given area according to some special program need. These may pertain either to our own program or to some apparently unrelated area. The reports from BSIE are often used as the key

which makes it possible for us to survey the literature in a relevant field quickly and easily.

However, it is unlikely that BSIE should or could maintain the exact coding and breakdown appropriate to the needs of this office. In addition, categorization of a research project is often a matter of professional judgment. It is in connection with the implication and significance of research that the Institute's program analysis activities are most important. It is important, also, to bear in mind that such an analysis depends frequently upon the published results of research, whereas the BSIE information relates to research in progress.

National Cancer Institute

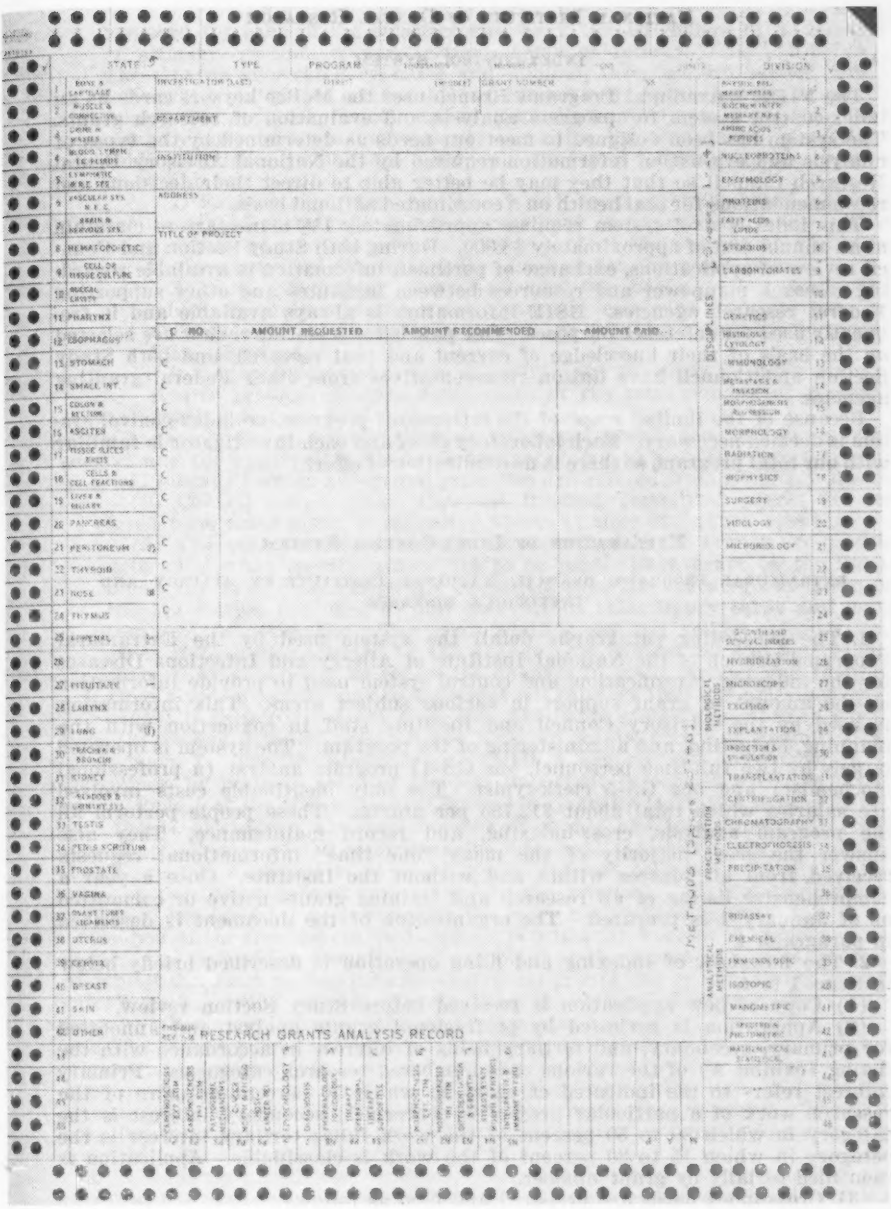
RESEARCH GRANT INDEX CONTROL SYSTEM

For statistical analytic purposes each active cancer research grant is classified according to (1) major area of research, (2) sites, (3) scientific discipline, (4) method, and (5) State or other political unit on a McBee keysort punchcard. The "major areas" of cancer research are determined according to the basic fields of cancer research: development of cancer (carcinogenesis), epidemiology, diagnosis, host-tumor relations, pharmacology, toxicology, and therapy. These major areas constitute "facets." Basic research in normal tissues is somewhat similarly classified by fact, development (morphogenesis), differentiation and growth, studies in steady state morphology and physiology, and integrative and immune physiology. Identification is made of research with human subjects (M), other animals (A), or plants (P). The analyst reads the research plan outlined in a grant (or application) and, as may be necessary, the progress reports describing work performed by the grantee. From these the most important facet, site, discipline, etc., are determined (one only per facet, etc.) and both holes of the pertinent card entry are punched out. Any number of requisite secondary facets, etc., may be selected, and then only the peripheral hole in the card is punched out. The sites, disciplines, and methods on the card are those found to be typically associated with cancer research. Other information coded on the card is descriptive: grant number, amount awarded, and fiscal year concerned.

Statistical information is thus readily obtained from the foregoing records by fiscal years (time series) to show net changes in number of grants and amounts awarded, average amounts per grant and trends for these (by method of least squares) over a considerable period of time for any category (State, therapy, etc.).

This method of analysis permits one to determine the major trends in research supported by cancer grants both qualitatively (subject matter) and quantitatively (funds expended).

Two employees are required to prepare these and similar reports.


STATE
TYPE
PROGRAM
DIVISION
INVESTIGATOR (LAST)
FIRST
INITIAL
GRANT NUMBER
DEPARTMENT
INSTITUTION
ADDRESS
TITLE OF PROJECT
FY
NO.
AMOUNT REQUESTED
AMOUNT RECOMMENDED
AMOUNT PAID
1 BONE & CARTILAGE
2 MUSCLE & CONNECTIVE
3 SKIN & MEMBR.
4 BLOOD, LYMPH, RE. ELEMS
5 LYMPHATIC (INCL. SPL.
6 VASCULAR SYS. INCL. C.
7 BRAIN & NERVOUS SYS.
8 HEMATOPOIETIC
9 CELL OR TISSUE CULTURE
10 BUCCAL CAVITY
11 PHARYNX
12 ESOPHAGUS
13 STOMACH
14 SMALL INT.
15 COLON & RECTUM
16 ASCITES
17 TISSUE SLICES EXCIS.
18 CELLS & CELL FRACTIONS
19 LIVER & BILIARY
20 PANCREAS
21 PERITONEUM
22 THYROID
23 NOSE
24 THYMUS
25 ADRENAL
26
27 PITUITARY
28 LARYNX
29 LUNG
30 TRACHEA & BRONCHI
31 KIDNEY
32 BLADDER & URINARY SYS.
33 TESTIS
34 PENIS SCROTUM
35 PROSTATE
36 VAGINA
37 OVARY TUBE ATTACHMENTS
38 UTERUS
39 CERVIX
40 BREAST
41 SKIN
42 OTHER
RESEARCH GRANTS ANALYSIS RECORD
DISCIPLINES
METHODS EMPLOYED
PROTOCOL FACTORS
ANALYTICAL PROCEDURES
BIOCHEMISTRY
BIOPHYSICS
MICROBIOLOGY
PHARMACOLOGY
PHYSIOLOGY
PATHOLOGY
CYTOLOGY
GENETICS
IMMUNOLOGY
METABOLISM & NUTRITION
MORPHOGENESIS & DIFFERENTIATION
MORPHOLOGY
RADIATION
SURGERY
VIROLOGY
MICROBIOLOGY
SPECIAL SENSE ORGANS
HYBRIDIZATION
MICROSCOPY
EXCISION
EXPLANTATION
INDUCTION & STIMULATION
TRANSPLANTATION
CENTRIFUGATION
CHROMATOGRAPHY
ELECTROPHORESIS
PRECIPITATION
RADIOISOTOPE
CHEMICAL
IMMUNOLOGIC
ISOTOPIC
MANOMETRIC
OSMOTIC & PHOTOMETRIC
MATHEMATICAL & STATISTICAL

National Institute of Dental Research

INDEX-CONTROL SYSTEM

The NIDR Extramural Programs Branch uses the McBee keysort cards as an index-control system for program analysis and evaluation of research grants. The system has been designed to meet our needs as determined by the types of analysis and evaluation information required by the National Advisory Dental Research Council so that they may be better able to direct their decisions and recommendations for oral health on a coordinated national basis.

This index-control system requires approximately 1½ man-years to maintain at an annual cost of approximately $8,000. During both Study Section and Council review of applications, exchange of pertinent information is available regarding research manpower and resources between institutes and other supporting Federal research agencies. BSIE information is always available and is frequently used for reference purposes. Our panels for scientific review are selected on the basis of their knowledge of current and past research, and both Study Section and Council have liaison representatives from other Federal granting agencies.

Because of the limited scope of the intramural program, no index-control system is deemed necessary. Each laboratory chief and each investigator is familiar with our total program, so there is no duplication of effort.

Explanation of Index-Control System

EXTRAMURAL PROGRAMS BRANCH, NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

1. The succeeding paragraphs detail the system used by the Extramural Programs Branch of the National Institute of Allergy and Infectious Diseases for the indexing, classification, and control system used to provide information on the amount of grant support in various subject areas. This information is used by the Advisory Council and Institute staff in connection with the planning, budgeting, and administering of the program. The system is operated largely by two full-time personnel, one GS–11 program analyst (a professional biochemist) and one GS–5 clerk-typist. The only identifiable costs involved are salaries which total about $12,755 per annum. These people perform all the program analysis, cross-indexing, and record maintenance. They also answer the great majority of the many "one time" informational requests received from all sources within and without the Institute. Once a year a comprehensive listing of all research and training grants active or committed as of January 1 is prepared. The organization of the document is described in paragraph 4.

2. The flowsheet of indexing and filing operation is described briefly below in items 1 to 4.

(1) Copy of new application is received before Study Section review.

(2) Application is reviewed by professional grants analyst and annotated for primary, secondary, and tertiary fields of interest in accordance with the listing (exhibit A) of the various code numbered research categories. Primary interest refers to the indicated category in which 50 percent or more of the research work of a particular project is concerned; secondary interest is the category in which 30 to 50 percent of the work falls; tertiary interest is the category in which 15 to 30 percent of the work is classifiable. Application is then filed serially by grant number.

(3) Cross-index cards are prepared and filed as follows:

(*a*) By principal investigator. Gives names and grant number. Annotated whether active, deferred, pending, disapproved, withdrawn, terminated. This is a master file of all grant applications ever received by this office and the annotations provide the history of all grants made to any one investigator.

(*b*) By coinvestigator. Gives names and grant number.

(*c*) By institution (within a given State). Two files maintained—one for active, one for pending grants. Each institution has an active and a pending card and grant numbers are entered or removed as necessary.

(*d*) By research category code number (from exhibit A). Three files (pending, committed, and active) are maintained. These three files reflect the status of action on a grant. Three cards are prepared for each grant—

one card for each of the subcategories (e.g., the -06 cholera of 3-bacteria) of primary, secondary, and tertiary fields of interest (see exhibit A). These cards give category name and number, investigators' names, funds for each grant period (requested or committed), fiscal year from which funds were supplied, council action (including priority rating), the other category code numbers (subcategory cards for the secondary and tertiary fields of interest which are used only for cross-reference purposes give grant number only).

1. Each category file (e.g., 3-bacteria) has a green lead card which is annotated every time a subcategory card is removed or added. This provides an up-to-date cumulative record of the number of grants in the category and the total dollar funding for the grant period.

2. Each subcategory (e.g., 3-06 cholera) has a yellow lead card which is similar to the green category lead card and provides an up-to-date record of the total number of grants and total funding for that subcategory.

3. A grand total card is also maintained similarly by daily annotation to provide an up-to-date record of the total number of research grants and total funding in all categories.

3. Changes in the status of action on individual grants flow in from several sources and the appropriate file cards are annotated to keep the record timely.

(1) Study Section action and priorities are entered from summary sheets.

(2) Council actions (e.g., approval, funding, committed years) are entered from notes made on summary sheets at time of Council meeting.

(3) The encumbrance lists prepared elsewhere in the branch are used to determine when specific grants are to be paid. Each grant on the list is noted, the grant application file consulted, then the subcategories given on the application are used to pull the various subcategory cards and move them to the active file. The appropriate green and yellow category lead cards in both files affected by the change (e.g., committed and active) are changed by annotation to reflect the changes in grant number and funding.

4. Once a year a comprehensive document (in January 1960 this contained some 240 pages) is prepared (chiefly from the card index system described in par. 2, item (3)) which lists all research and training grants, active or committed, as of January 1. The 20 categories of exhibit A are reduced in number to 17 disciplines, by lumping some of the less important categories with the major ones. Page 1 of the comprehensive document typically looks like exhibit B and lists the 17 disciplines, the total number of grants and total funding in each discipline. Page 3 of the comprehensive document typically looks like exhibit C and presents a résumé of areas of special interest. These are areas of historic or particular current importance to the program. All grants listed on exhibit C are included somewhere on the more comprehensive exhibit B.

The rest of the comprehensive document is primarily a series of sections corresponding to each of the disciplines of exhibit B or the "areas of special interest" of exhibit C. Each section lists the individual grants line by line, giving investigator's name, grant number, yearly funding, institution, and a short title. Certain other miscellaneous summary tables also appear.

5. The category list—exhibit A—is the key to the whole system of information storage and retrieval. It is a pragmatic creation based chiefly on diseases and agents of disease, but includes certain other categories like epidemiology, biochemistry, and detection which experience has shown are useful. The category list is expanded as new areas of research are discovered or as a further fragmentation of an old area is found useful.

6. This highly satisfactory system of information storage, cross-indexing, and retrieval has been in use for about 9 years. Successive requests for information have rarely been couched in identical terms but this system has been fast and efficient in providing up-to-the-minute answers. It is flexible, relatively low in (initial) cost and maintenance. Several times in the past few years serious consideration has been given to the feasibility of automating the system at the branch level. Until the volume of grant awards increases considerably, the experts at NIH have stated that complete automation would not be likely to result in appreciable savings of time and money. It is possible that limited automation of the sort provided by the Flexowriter system might provide for certain operations savings in time and increased accuracy. A serious question seems to be whether the information in a highly automated system could be so easily and rapidly updated as the many inevitable changes occur in the administration of grants.

EXHIBIT A

Antibiotics	1–00
Arthropods (entomology)	2–00
Bacteria	3–00
Anthrax	3–01
Acid-fast mycob.	3–02
Shigellosis, B. dys.	3–03
Clostridia	3–04
Brucellosis	3–05
Cholera	3–06
Diphtheria	3–07
Escherichia-coli	3–08
Gonococci	3–09
Leprosy	3–10
Listeriosis	3–11
Meningococci	3–12
Salmonellosis	3–13
Pertussis	3–14
Plague	3–15
Pneumococci	3–16
Sarcoidosis	3–17
Staphylococci	3–18
Streptococci	3–19
Tetanus	3–20
Tuberculosis	3–21
Tularemia	3–22
Typhoid	3–23
Bacteria, nonspec.	3–90
Biochemistry	4–00
Chemotherapy	5–00
Detection (rap. ident.)	6–00
Epidemiology	7–00
Fungi	8–00
Actinomycosis	8–01
Blastomycosis	8–02
Coccidioidomycosis	8–03
Cryptococcosis	8–04
Dermatophytosis	8–05
Histoplasmosis	8–06
Moniliasis	8–07
Nocardiosis	8–08
Sporotrichosis	8–09
Ringworm (tricho., microsp., epidermo.)	8–10
Fungi, nonspec.	8–90
Genetics	9–00
Helminths	10–00
Ankylostomiasis (hookworm)	10–01
Ascariasis (roundworm)	10–02
Clonorchiasis (liver fluke)	10–03
Trichinosis	10–04
Enterobiasis (pinworm)	10–05
Filariasis	10–06
Hydatid (echinococcosis)	10–07
Trematodes (flukes)	10–08
Nematodes	10–09
Onchoceriasis (filarial worms)	10–10
Paragonimiasis (lung fluke)	10–11
Schistosomiasis	10–12
Tapeworm (taenia, dyphyllo.)	10–13
Trichuriasis (threadworm, whipworm)	10–14
Acanthocephaliasis	10–15
Strongyloidiasis (nematode)	10–16
Helminths, nonspecific	10–90

Immunology ---- 11–00
Cystic fibrosis ---- 11–01
Bacterial (general) vaccines ---- 11–02
Staphylococcal vaccines ---- 11–03
TB vaccines ---- 11–04
Viral vaccines ---- 11–05
Fungal vaccines ---- 11–06
Protozoa vaccines ---- 11–07
Helminth vaccines ---- 11–08
Immunology, nonspecific ---- 11–90
Allergy ---- 12–00
Airborne (hay fever, asthma, fungi) ---- 12–01
Contact dermatitis (plants, chemicals, ingestants, helminths, insect bites, skin tests) ---- 12–02
Drug and chemical hypersensitivities (including antibiotics) ---- 12–03
Food hypersensitivities ---- 12–04
Histamine (including antihistaminics) ---- 12–05
Serotonin (including tranquilizers) ---- 12–06
Allergy, nonspecific ---- 12–90
Protozoa ---- 13–00
Amebiasis ---- 13–01
Malaria ---- 13–02
Toxoplasmosis ---- 13–03
Trypanosomiasis ---- 13–04
Leishmaniasis ---- 13–05
Paramecia ---- 13–06
Trichomoniasis ---- 13–07
Coccidiosis ---- 13–08
Protozoa, nonspecific ---- 13–90
Public health and sanitation ---- 14–00
Physiology ---- 15–00
Radiation ---- 15–01
Infancy ---- 15–02
Physiology, nonspecific ---- 15–90
Rickettsia ---- 16–00
Q fever ---- 16–01
Rickettsial pox ---- 16–02
Rocky Mountain spotted fever ---- 16–03
Typhus ---- 16–04
Rickettsia, nonspecific ---- 16–90
Spirochetes ---- 17–00
Leptospirosis ---- 17–01
Syphilis ---- 17–02
Yaws ---- 17–03
Spirochetes, nonspecific ---- 17–90
Taxonomy ---- 18–00
Viruses ---- 19–00
Bullis fever ---- 19–01
Chicken pox (varicella) ---- 19–02
Common cold:
Adenoviruses, ARD (acute respiratory), APC (adenoidal, pharyngeal, conjunctival) ---- 19–03
Coxsackie viruses ---- 19–04
Dengue ---- 19–05
Encephalitis ---- 19–06
Foot-and-mouth disease ---- 19–07
Distemper ---- 19–08
Herpes simplex ---- 19–09
Herpes zoster ---- 19–10
Infectious hepatitis ---- 19–11
Infectious mononucleosis ---- 19–12
Influenza ---- 19–13
Measles (rubeola) ---- 19–14

Viruses—Continued
Lymphocytic choriomeningitis ---- 19–15
Mumps ---- 19–16
Ornithosis ---- 19–17
Poliomyelitis ---- 19–18
Pleuropneumonialike organisms ---- 19–19
ECHO ---- 19–20
Rabies ---- 19–21
Rubella (German measles) ---- 19–22
Salivary-gland virus ---- 19–23
Smallpox (variola) ---- 19–24
Trachoma ---- 19–25
Vesicular exanthema ---- 19–26
Yellow fever ---- 19–27
Virus pneumonia ---- 19–28
Viral dysentery ---- 19–29
Cat-scratch fever ---- 19–30
Colorado tick fever ---- 19–31
Viruses, nonspecific ---- 19–90
Degenerative diseases ---- 20–00

Index-Control Systems of the National Heart Institute

The NHI maintains index-control systems for both extramural and intramural research projects. However, the extent and nature of the systems depend upon the primary functions for which the systems are required.

Classifications of research areas are maintained on a continuing basis for internal administrative use in determining program balance and emphasis. More detailed project indexing is maintained in the extramural activities where the volume and range of research is beyond the scope of individual, direct supervision that is possible with intramural research projects. The specific systems in operation are:

Index-control systems for extramural research projects

The major index-control system for the extramural research grant program is lodged in the Analysis and Reports Section, where current information on the approximately 1,800 active research grants is maintained. Each project is classified on several axes, the most important being:

1. Research area, primarily disease oriented.
2. Scientific discipline involved.
3. Clinical implications.
4. Species employed.

Each grant awarded is initially classified on the basis of statements in the great application which indicate the investigator's intentions. From time to time (approximately annually) the classifications of the project are modified according to progress reports which the investigator submits.

Because of the complex nature of cardiovascular research, several categories on each of the above axes are assigned to most projects, and for each axis, one of the categories is designated as "major" and the other "minor." The amount of the award, year by year, is recorded for each project, so that fiscal information, of the type for broad research areas, is available in whatever amount of detail is desired for a particular purpose.

The classifications are recorded on the McBee card, which is the major index and control for the purpose of retrieving information. In addition to the classifications shown on the card (copy attached), many subclassifications on subjects of particular interest are also recorded. Using the card as the index, additional detail on any subject is secured by recourse to parallel files of grant applications and progress reports.

Fiscal information by research area and by scientific discipline is regularly reviewed by the Director and staff of the Heart Institute and discussed with the National Advisory Heart Council in planning overall program development and determining areas of need. Budget documents also include much of this information.

In addition to periodic reports which are routinely prepared, many special requests for information on specific subjects are filled through the index

system. These requests may come from the council, the NHI staff, the NIH staff, the Congress, the scientific public, and the general public.

The index-control system of the several Institutes vary with their needs and the resources devoted to them. The Division of Research Grants maintains records on all applications received, and action on them, for all Institutes, but without classification according to the axes noted above. DRG's Statistics and Analysis Section, through its coordinate index system, classifies all published material (not application or progress report data) resulting from NIH research grants.

Operation of the NHI index-control system has required annually about 8 man-years, $45,000 for personnel, and $9,000 for "other expenses"—supplies, equipment, etc., but not including cost of office space or maintenance service. Because of the increasing volume of cardiovascular research, these must be increased.

Summaries of all research grant applications to NIH, and statements of awards, are forwarded to the Bio-Sciences Information Exchange, as they are by most other Government and private research granting agencies. Prior to each meeting of the Heart Council, BSIE supplies information on all current research grant support from all sources known to BSIE for each investigator who has an application pending consideration by the Heart Council.

Because of the increasing volume of cardiovascular research grants, the time may have come when an electronic data-processing system should be employed. The problems of classification of complex data by professionally trained personnel has seemed more important than the mechanical problems of retrieving data; these will remain with us no matter what type of machine process is used.

INDEX-CONTROL SYSTEM FOR INTRAMURAL RESEARCH PROJECTS

The same type of classification of intramural research projects as that used with the extramural projects has been applied for uniformity of general information relating to the extent of support for different subject areas.

The direct continuing contact between research investigators and their laboratory chiefs and the scientific director provides detailed information about intramural research. Index-control systems have not been found to be of significant value to the intramural scientists or the scientific director. The direct procedures of project review and approval by laboratory chiefs and by the scientific director allow close supervision of intramural research activities.

An annual project summary report gives a detailed description of all intramural research projects and is provided for internal administrative use of the Director, NHI; the scientific directors of other institutes; the Associate Director of Intramural Research, NIH; Director, NIH, Board of Scientific Councilors; and the National Advisory Heart Council.

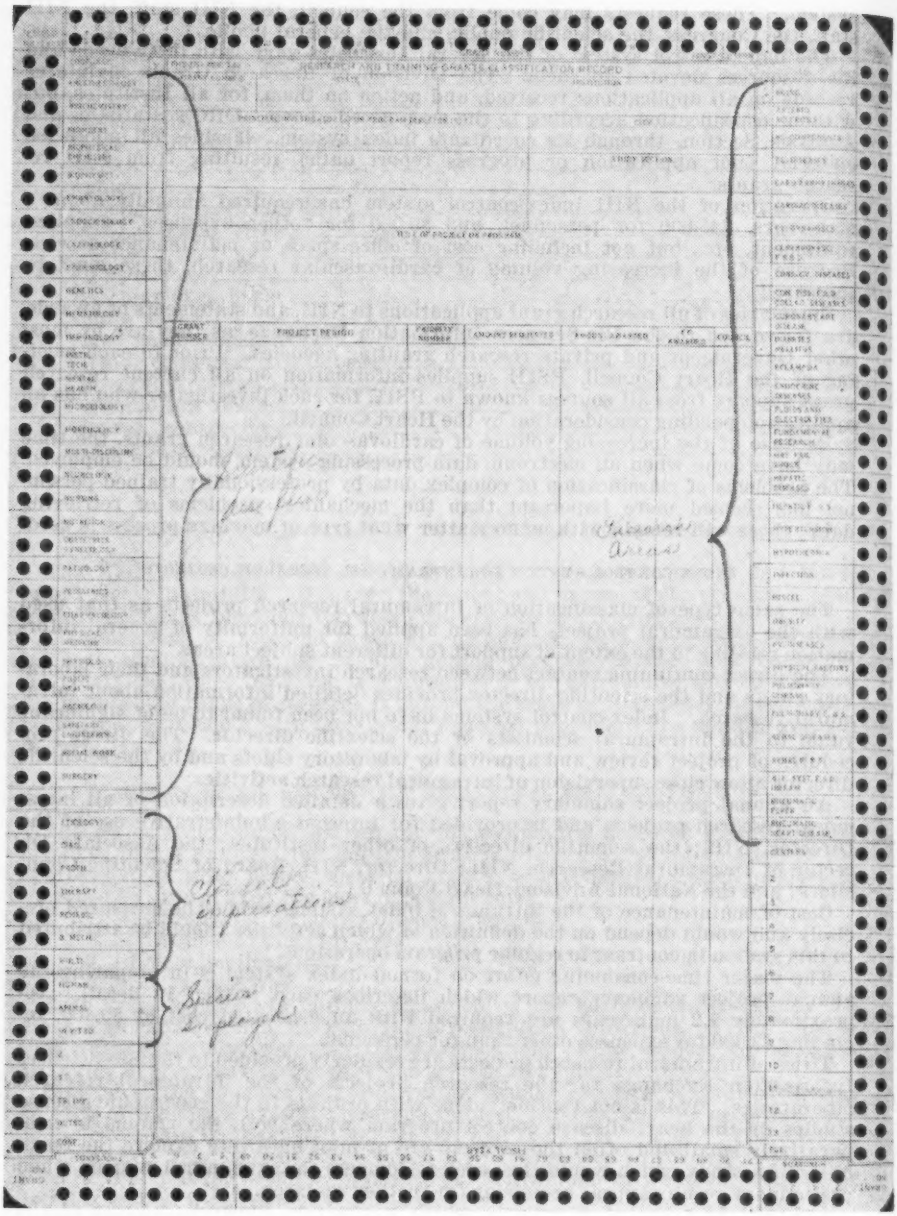
Cost of maintenance of the intramural index systems cannot be measured precisely and would depend on the definition of which activities should be attributed to this system in contrast to regular program operations.

The major time-consuming effort on formal index system is in preparing the annual project summary report which describes each project in detail. Approximately 1.2 man-years are required with an estimated cost of $9,400, including $3,400 for expenses other than for personnel.

Titles of intramural research projects are regularly provided to the Bio-Sciences Information Exchange for the research projects of the intramural research laboratories. This is not routinely done with projects in the geographic disease studies or the heart disease control program where both the volume is comparatively small and often the projects are of pilot nature to explore the feasibility of a study which would then seek to compete for extramural support when preliminary results appear promising for further research.

Attached is a list of documents which summarize research projects of the National Heart Institute for either internal administrative purposes or for external distribution to professional persons, the Congress, or to the public. Sample copies of these documents are also attached for further amplification of the type of summary material which is provided relating to research projects supported or conducted by the Heart Institute.

Attention is directed to the document "Summary of Awards by Research Areas, Fiscal Years 1949–59." The growth of extramural research support by disease area and by discipline area is summarized and provides data of particular value to the Director of the Heart Institute and to the National Advisory Heart Council in guidance of the programs of the National Heart Institute.



Documents summarizing National Heart Institute research projects

	Primary purpose	
	Administrative or intramural use	External distribution
1. Research Publications of the National Heart Institute, January 1953–June 1958.	X	X.
2. Diet, Hormones, and Atherosclerosis, a Review of Research Grants Supported by the National Heart Institute, Fiscal Years 1949–58.	X	X.
3. PHS Support of Cardiovascular Research, Training, and Community Programs, Active Feb. 1, 1960.	X	X.
4. The Clinical Center, Current Clinical Studies and Patient Referral Procedures, Revised 1958.		X.
5. National Heart Institute Summary of Awards by Research Areas, Fiscal Years 1949–59.	X	
6. Highlights of Heart Progress, 1958		X.
7. Aging, a Review of Research and Training Grants Supported by the National Heart Institute, Fiscal Years 1949–58.	X	X.
8. Notes: Current Research in Cardiovascular Disease," postgraduate course No. 5, the American College of Physicians, May 16–20, 1960, NHI.		X.
9. Currently Active Research Grant Projects Investigating the Role of Estrogens in Atherosclerosis (Fiscal Year 1959).	X	

National Institute of Mental Health

RESEARCH DATA CODING PROCEDURES

The Research Grants and Fellowships Branch of the National Institute of Mental Health is currently using two systems for indexing extramural research information. The first of these provides detailed coded data describing the content of the extramural research program (see enclosure 1); data for this system are stored on IBM punchcards within the Statistical Processing Section of NIH. A second system provides information for describing grants research in terms of four broad program breakdowns (see enclosure 2); here the data are stored within the branch on McBee keysort cards.

It is estimated that 7 man-years and $42,000 are spent annually in maintaining the IBM punchcard system. The total cost for the shorter system, utilizing McBee cards, is approximately 2 man-years and $10,000 annually. Because of its greater scope and detail, and because current plans call for incorporating the McBee card data into the punchcard format, the following discussion will center on the major of the two systems.

For each research grant supported by NIMH, specific information is recorded within the following major categories, using grant applications. Study Section summary sheets, journal reprints, and progress reports as sources of data:

(*a*) Scientific field of study and major area of mental health research.
(*b*) Type of mental and emotional disorder.
(*c*) Nature of symtoms and syndromes.
(*d*) Clinical goals of the research.
(*e*) Type of therapy.
(*f*) Organic process.
(*g*) Psychological and social focus of study.
(*h*) Type of subjects used.
(*i*) Research orientation—basic versus applied, clinical versus experimental, etc.

(*j*) Discipline and training of the investigator.
(*k*) Type of sponsoring institution and department.
(*l*) Type of nonsponsoring institution involved in the research and the nature of its support.
(*m*) Research techniques used.
(*n*) Reasons for approval or disapproval.
(*o*) Fiscal data.

Two major purposes are served by the maintenance of the coding system. First, it permits relatively quick retrieval of information about the program—i.e., the identification of specific projects (including titles, investigators, and location) falling into a given area of research. Second, it provides the basis for detailed tabular analyses of both the current substance and the history of the grants program.

In satisfying these needs, the Branch utilizes both the Bio-Sciences Information Exchange index system and the NIH coordinate index system to complement its own data—the former primarily for information retrieval purposes, the latter for supplementary program analysis data:

(*a*) Although no single indexing system can fully anticipate all of the potential demands to be made upon it for information retrieval, the Branch coding procedures, by taking into account the kinds of questions normally asked about mental health research and by using comprehensive sources of data, provides a satisfactory vehicle for retrieving information about the extramural program. It has been possible in recent weeks, for example, to provide machine-printed lists of NIMH-sponsored research in such diverse areas as hypnosis, nursing education, social behavior among animals, sensory deprivation, depression, brain damage, psychosomatic factors in children's asthma, and suicide. Such lists have been prepared at the request of a variety of sources, among them scientists in the field, Branch and Institute staff personnel, other Federal agencies, professional societies and representatives of mass media. The Bio-Sciences index system is utilized when comparable data concerning research sponsored by agencies other than NIMH are sought, i.e., when the information required is not directly available from the Branch coding system. It should be noted that the Bio-Sciences files are derived from notices of research which summarize projects in broad outline; they are therefore not likely to yield as comprehensive information as coded data based on considerably more specific sources.

(*b*) Requirements for quantitative descriptions and analyses of the NIMH extramural program involve a combination of substantive and administrative data; the Branch coding system focuses on the first of these, the NIH coordinate index system on the latter. The Research Grants and Fellowships Branch plans, therefore, to utilize the NIH system to supplement its own information dealing with the subject matter of grants research. For example, a tabular analysis of the scientific orientations of those investigators working on schizophrenia in children can be supplemented with detailed information describing the grants involved in terms of Study Section assignments, funds requested, date of awards, etc. The coded data provide continuing analyses to indicate relative emphases within the program, and to aid in program development, grant review procedures, and policy determinations. Current efforts will permit historical studies of trends within the extramural program, both in fiscal and substantive terms.

The Branch coding system has been operational for only about a half year, and it is likely to undergo changes in the light of experience and future requirements. Nevertheless, it would appear that a local system maintained by the Branch is a continuing requirement. Only such a system can incorporate the substance of mental health research in its specific details, and take account of the diverse subject matter and disciplines represented in the field. Day-to-day demands for quick information and analyses specific to the unique field of mental health research are not likely to be met adequately by a global system outside the Branch.

This does not mean, however, that a comprehensive Federal system, combining both substantive and administrative data, is not possible or useful. Such a system, utilizing new electronic data storage and retrieval methods, could serve at a general level, e.g., to provide comprehensive surveys of large areas of biomedical research. Even if such procedures were to become a reality, however, the need would continue—certainly within NIMH—for a smaller coding operation which focuses directly on the Institute's specialized subject matter and administrative needs.

Research Grants Program Codes

National Institute of Mental Health Research Grants and Fellowships Branch, August 4, 1960

ENCLOSURE 1

GRANT NO.				C NO.	TYPE	DATE CODED	FISCAL AMOUNT								FISCAL YEAR		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

CLINICAL GOALS	PRIM GOAL
None of following	22
Etiology	23
Descr-symp, synd	24
Descr-course	25
Epidemiology	26
Diagnosis	27
Prognosis	28
Public education	29
Prevention	30
Cure	31
Treatment	32
Rehabilitation	33
Training	34
Prov publ serv	35
	36

THERAPY	PRIM GOAL
None	37
Psychoanalysis	38
Indiv psychoth	39
Oth psych ther	40
Group psychoth	41
Adjunctive ther	42
Psychosurgery	43
Shock	44
Drugs	45
Oth somatotherapy	46
Other	47
Unspecified	48

DATA GATHERING TECHNIQUES	PRIM DISCR
None of following	49
Contr observations	50
Natur observations	51
Case histories	52
Clinical interv	53
Field interv	54
Content analysis	55
Personality inv	56
Rorschach	57
Other proj tests	58
Intell tests	59
Ach, Apt tests	60
Att, Val, Int tests	61
Perf tests	62
Rating scales	63
Questionnaires	64
Oth psych tech	65
Electrophys	66
Biochemical	67
Anthropometric	68
Other biol tech	69

EXPERIMENTALLY INDUCED STATES	
None of following	70
Convuls, Seiz	71
Drive state	72
Emotional state	73
Drug ind state	74
Psychosom, Neur	75
	76
	77

A D	CARD #	
	78	
	79	0
	80	2

MISCELLANEOUS SYMPTOMS, SYNDROMES, DISEASES	PRIM DISCR
Skin	70
Sex malfunction	69
Phobias	68
Obsess Compuls	67
Obesity	66
Neoplasm	65
Metabolic	64
Hysteria	63
Headache	62
Glandular	61
Gastrointestinal	60
Exot reac psys dis	59
Depression	58
Dental	57
Circulatory	56
Autistic behavior	55
Anxiety	54
Allergies	53
Aggression, Act out	52
None of following	51

DISORDERS	PRIM DISCR
Alcoholism	38
Sex Deviations	39
Speech, Hear, Read	40
Psychosomatic	41
Convulsive States	42
Brain Damage	43
Other Neur Disord	44
Sensory Disorders	45
Disord of Old Age	46
Drug Addiction	47
Other	48
Unspecified	49
None of following	50
Anxiety	54
Autistic behavior	55
Circulatory	56
Dental	57
Depression	58
Exot reac psys dis	59
Gastrointestinal	60
Glandular	61
Headache	62
Hysteria	63
Metabolic	64
Neoplasm	65
Obesity	66
Obsess Compuls	67
Phobias	68
Sex malfunction	69
Skin	70
Suicide	71
	72
	73
	74
	75
	76
	77

A D	CARD #	
	78	
	79	0
	80	1

DISORDERS	PRIM DISCR
None	22
Schizophrenia	23
Depress Psychosis	24
Other Psychosis	25
Neurosis	26
Disp Psych Disorder	27
Hospital Sa	28
Other Instit Sa	29
Clinic Sa	30
Community Sa	31
Other Sa	32
Unspecified Sa	33
Mental Retardation	34
Child Behav Disord	35
Juvenile Delinquency	36
Criminality	37

GRANT NO.	C NO.	T Y P E	DATE CODED	FISCAL AMOUNT	FISCAL YEAR
1 2 3 4	5 6	7	8 9 10	11 12 13 14 15 16 17	18 19 20 21

	ORGANIC PROCESSES	HUMAN SS STUDIED	STAGE OF DEVELOPMENT OF HUMAN SUBJECTS	NON-HUMAN SS STUDIED	STAGE DEV NON-HUM SS	RESEARCH APPROACH	TYPE OF RESEARCH	A D	CARD #
22	None of following								
23	Circulatory								
24	Digestive								
25	Glandular								
26	Integumentary								
27	Metabolic								
28	Neural								
29	Physical Maturation								
30	Reproductive, Sexual								
31	Respiratory								
32	Sensory								
33	Sleep, Rest, Fatigue								
34	None								
35	Male								
36	Female								
37	Both								
38	Unspecified sex								
39	No human subjects								
40	Prenatal								
41	Neonatal								
42	Infancy								
43	Childhood								
44	Adolescence								
45	Adult								
46	Aged								
47	Unspecified stage								
48	None								
49	Primates								
50	Rodents								
51	Other								
52	Unspecified type								
53	No non-human subjects								
54	Young								
55	Old								
56	Unspecified stage								
57	Inapplicable								
58	Clinical								
59	Experimental								
60	Both								
61	None of following								
62	Chairman Grant								
63	Program Grant								
64	Conference								
65	Travel survey								
66	Review of literature								
67	Writing a book								
68	Support of publications								
69	Support comnty, org								
70	Survey research								
71	Theory building								
72	Methods, technique dev								
73	Translation								
74	Foreign Grants								
75									
76									
77									
78									
79									
80									
								C	3

	UTILITY OF RESEARCH	DIRECTNESS OF RESEARCH	WEAKNESS OF RESEARCH	SMALL GRANTS	A D	CARD #
22	Unspecified	None of following	Incompetence of investig	Other		
23	Totally basic	Competence of investig	Incompetence of staff	Explor/atory, pilot study		
24	Basic-applications impl	Competence of other staff	None of following	Small college		
25	Basic-applications expl	Importance of research	Inadq of research	Young investigator		
26	Equal	Good setting	Poor setting	Inapplicable		
27	Applied-basic explicit	Appropriate budget	Budget too high	Results valueless		
28	Applied-basic implied	Ingenious approach	Unimaginative approach	Too nebulous		
29	Totally applied	Well designed	Faulty design	Scope too broad		
30	None of following	Nearly studied area	Inadequate coverage	Inappropriate measures		
31	Competence of investig	Fill gap in information	Area well covered	Information known		
32	Competence of other staff	Approp meas, tech	Inadequate information	Area well covered		
33	Importance of research	Scope well-defined	Inappropriate measures	Too nebulous		
34	Good setting	Proposal clear	Scope too broad	Results valueless		
35	Appropriate budget	Meaningful results	Too nebulous	Young investigator		
36	Ingenious approach	Provide training	Results valueless	Small college		
37	Well designed		Young investigator	Explor/atory, pilot study		
38	Nearly studied area		Small college	Other		
39	Fill gap in information		Explor/atory, pilot study			
40	Approp meas, tech		Other			
41	Scope well-defined					
42	Proposal clear					
43	Meaningful results					
44	Provide training					
45	None of following					
46	Incompetence of investig					
47	Incompetence of staff					
48	Inadq of research					
49	Poor setting					
50	Budget too high					
51	Unimaginative approach					
52	Faulty design					
53	Area well covered					
54	Information known					
55	Inappropriate measures					
56	Scope too broad					
57	Too nebulous					
58	Results valueless					
59	Young investigator					
60	Small college					
61	Explor/atory, pilot study					
62	Other					
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						
77						
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80						
					D	4

GRANT NO.				C NO	TYPE	DATE CODED		FISCAL AMOUNT						FISCAL YEAR		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

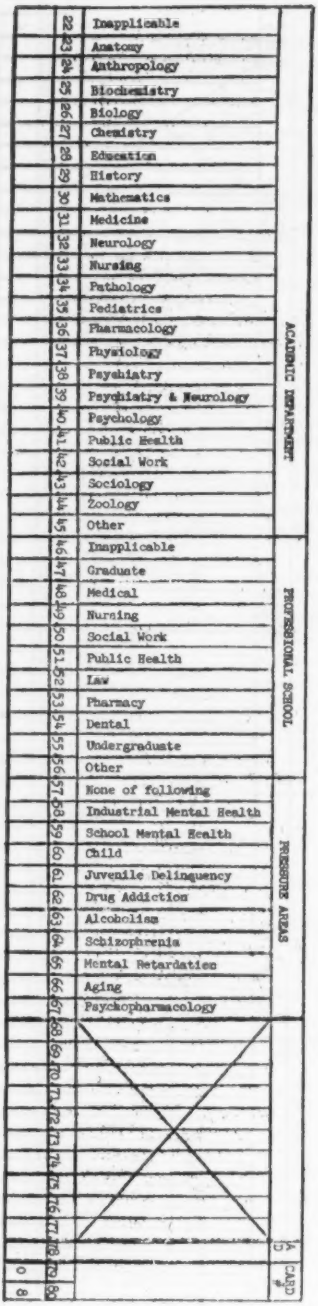
DISCIPLINES AMONG INVESTIGATORS

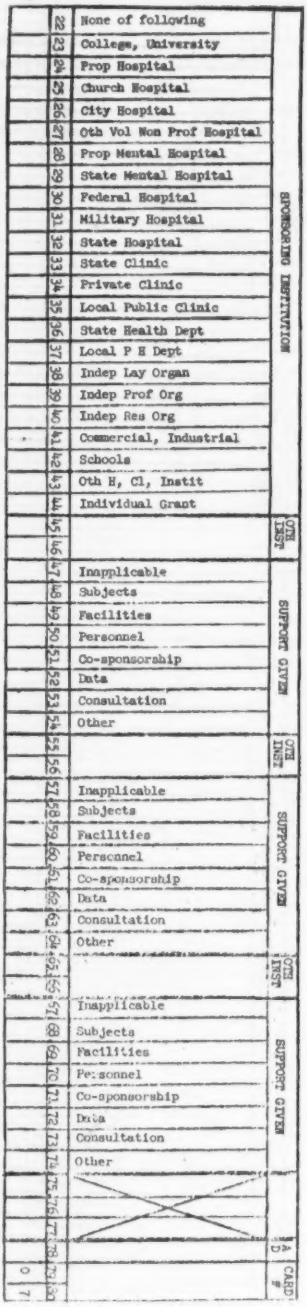
PRINC INVES

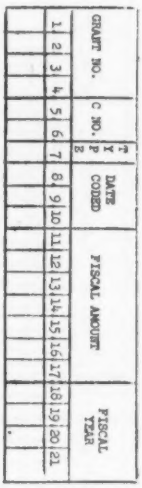
ACADEMIC TRAINING OF P I

A CARD D

| | | | | | | | | | | | | | | | | | | |


ACADEMIC DEPARTMENT
Inapplicable
Anatomy
Anthropology
Biochemistry
Biology
Chemistry
Education
History
Mathematics
Medicine
Neurology
Nursing
Pathology
Pediatrics
Pharmacology
Physiology
Psychiatry
Psychiatry & Neurology
Psychology
Public Health
Social Work
Sociology
Zoology
Other
PROFESSIONAL SCHOOL
Inapplicable
Graduate
Medical
Nursing
Social Work
Public Health
Law
Pharmacy
Dental
Undergraduate
Other
PROBLEM AREAS
None of following
Industrial Mental Health
School Mental Health
Child
Juvenile Delinquency
Drug Addiction
Alcoholism
Schizophrenia
Mental Retardation
Aging
Psychopharmacology
CARD #
0 8


SPONSORING INSTITUTION
None of following
College, University
Prop Hospital
Church Hospital
City Hospital
Oth Vol Non Prof Hospital
Prop Mental Hospital
State Mental Hospital
Federal Hospital
Military Hospital
State Hospital
State Clinic
Private Clinic
Local Public Clinic
State Health Dept
Local P H Dept
Indep Lay Organ
Indep Prof Org
Indep Res Org
Commercial, Industrial
Schools
Oth H, Cl, Instit
Individual Grant
OTH INST
SUPPORT GIVEN
Inapplicable
Subjects
Facilities
Personnel
Co-sponsorship
Data
Consultation
Other
OTH INST
SUPPORT GIVEN
Inapplicable
Subjects
Facilities
Personnel
Co-sponsorship
Data
Consultation
Other
OTH INST
SUPPORT GIVEN
Inapplicable
Subjects
Facilities
Personnel
Co-sponsorship
Data
Consultation
Other
CARD #
0 7


GRANT NO.
C NO.
P Y P
DATE CODED
FISCAL AMOUNT
FISCAL YEAR

GRANT NO.				C NO.		Sex P E	DATE CODED		FISCAL AMOUNT								FISCAL YEAR		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

| A D | CARD # | | | | | | | | | | | | | | | | | | |

RESEARCH GRANTS PROGRAM CATEGORIES

National Institute of Mental Health Research Grants and Fellowships Branch, August 4, 1960

ENCLOSURE 2

(1) General fields of research:
- Biology of mental illness.
- Developmental disorders.
- Sociology and epidemiology of mental illness.
- Diagnosis and treatment of the mentally ill.

(2) Program areas:
- Biochemistry of mental illness.
- Brain mechanisms and behavior.
- Psychosomatic problems.
- Pharmacotherapy in mental illness.
- Addiction to alcohol and drugs.
- Diagnosis and treatment in mental illness.
- Basic thought processes.
- Problems of aging.
- Mental disturbances in childhood.
- Social factors in mental illness.
- Improved care and rehabilitation of mentally ill.

(3) Special fields of research:
- Juvenile delinquency.
- Mental retardation.
- Alcoholism.
- Drug addiction.
- Aging.
- Accident prevention.
- Schizophrenia.
- Psychopharmacology.
- Industrial mental health.
- School mental health.

(4) Psychopharmacology research:
- Synthesis.
- Screening in animals.
- Screening in normal subjects (human).
- Early clinical screening.
- Controlled clinical trials:
  - Schizophrenia.
  - Depression.
  - Neurosis.
  - Children.
  - Aged.
  - Other.
- Basic studies of mechanisms of action.
- Method development and data analysis.

INDEX SYSTEM OF THE RESEARCH INFORMATION SECTION, DIVISON OF RESEARCH GRANTS, NIH

1. DOCUMENTS INDEXED

The section indexes notices of research projects (abstracts of the applications, prepared by the investigators), progress reports, and reprints of publications for the extramural programs of all the Institutes of NIH. It also indexes similar documents for the intramural NIH programs.

2. SYSTEM OF INDEXING

For the past 6 years the section has used the coordinate-indexing system, Beginning with fiscal year 1961 documents, the coordinate-indexing method will be modified to one of precoordination of terms. Table 1 illustrates the new method. The table shows combinations of terms and associated words: e.g., precoordination of meaningful terms.

This modified approach gives the same depth of indexing which is obtainable from the conventional coordinate-indexing method while elminating some of the disadvantages common to the latter. It minimizes false combinations of terms and facilitates the retrieval process.

3. METHOD OF RETRIEVAL

As shown in table 1, the precoordinated-index method provides direct access to stored information. Each combination of terms is typed on a separate card and filed alphabetically by the first term. Since each "term" card contains identifying information relating to the particular grant in which the term is used, the card provides most of the information needed in searches without resort to secondary files.

On a master card is typed all the indexed terms covering a particular grant. The master cards, filed numerically by grant number, serve as a control file. (The identifying information for each grant is presently typed on ditto, and the required number of cards reproduced from this ditto. This is the information shown in italic in table 1. I have requested the Statistical Processing Section to consider the possibility of furnishing us with prepunched IBM cards containing this identifying information as a byproduct of the Statistical Processing Section's operations.)

TABLE 1.—*Precoordinated-indexing system of the Research Information Section, DRG, NIH*

(Master card)----------'61 *B–547(C4)*
Abortion . . . monkey . . . virology
Adenovirus . . . congenital anomalies . . . monkey . . . pregnancy
Congenital anomalies . . . monkey . . . pregnancy . . . virology
Embryology . . . monkey . . . pregnancy/congenital anomalies
Influenza virus . . . monkey . . . pregnancy/congenital anomalies
Monkey . . . pregnancy . . . virology/congenital anomalies
Pregnancy . . . virology/abortion . . . monkey
Respiratory virus/congenital anomalies . . . monkey . . . pregnancy
Rubella virus/congenital anomalies . . . monkey . . . pregnancy
Rubeola virus/congenital anomalies . . . monkey . . . pregnancy
B–547(C4) John M. Adams Viral infections of the embryo H.E.D. $25,000 U. Cal., L.A.
(Term cards)
Abortion . . . monkey . . . virology----------'61 *B–547(C4)*
Adenovirus . . . congenital anomalies . . . monkey . . . pregnancy-- '61 *B–547(C4)*
Congenital anomalies . . . monkey . . . pregnancy . . virology---- '61 *B–547(C4)*
Embryology . . monkey . . . virology/congenital anomalies------ '61 *B–547(C4)*
Influenza virus . . . monkey . . . pregnancy/congenital anomalies '61 *B–547(C4)*
Monkey . . . pregnancy . . . virology/congenital anomalies------ '61 *B–547(C4)*
Pregnancy . . . virology/abortion . . . monkey---------- '61 *B–547(C4)*
Respiratory virus/congenital anomalies . . . monkey . . . pregnancy. '61 *B–547(C4)*
Rubella virus/congenital anomalies . . . monkey . . . pregnancy- '61 *B–547(C4)*
Rubeola virus/congenital anomalies . . . monkey . . . pregnancy- '61 *B–574(C4)*
B–547(C4) John M. Adams Viral infections of the embryo H.E.D. $25,000 U. Cal., L.A.

4. MECHANIZATION

We are using manual procedures with IBM cards during the formative stages of our new precoordinated-index system. The format of the data, however, is being developed in anticipation of coding and punching to facilitate (*a*) publication and (*b*) computer storage and retrieval.

(*a*) *Publication.*—The section plans to publish a scientific, subject-matter index to all NIH extramural grants awarded during fiscal year 1961.

The reproduction method for publication has not yet been decided, but among the suggestions obtained is that of photocopy, a method used by the National Library of Medicine to publish their Index Medicus. Should photocopy be selected, the line entries shown in table 1 in roman type will facilitate publication preparation. Using the data from table 1, those entries (combined with other grant numbers with similar entries) would appear in publication form as shown in table 2.

TABLE 2.—*Format of proposed index to extramural grants, fiscal year 1961*

Abortion
B–547(C4)———monkey . . . virology
Adenovirus
B–547(C4)———congential anomalies . . . monkey . . . pregnancy
Congenital anomalies
B547(C4)———monkey . . . pregnancy . . . virology
Embryology
B–547(C4)———monkey . . . virology/congenital anomalies

The identifying information to the indexed entries; e.g., grant number, name and address of investigator, title, and Study Section, will be given in an appendix. (The cooperation of the Statistical Processing Section has been requested in planning for the preparation of the appendix from the same IBM punched cards that will be used in that section's preparation of the NIH annual publication of awards, based on geographic and fiscal listings.)

(*b*) *Computer storage and retrieval*—The plans for publishing an index to extramural grants, for fiscal year 1961, using a precoordinated indexing system, were discussed with Dr. Robert Ledley during a recent visit in connection with his survey of NIH retrieval systems. Dr. Ledley suggested a slight modification in the arrangement of the associated terms, in deference to computer applications of these data. This modification is illustrated in table 2, under the entry for "Embryology." Note that the terms associated with "embryology"—"monkey * * * virology"—follow "embryology" in alphabetical sequence. The slant line between "virology' and "congenital anomalies" is a symbol to indicate that "congenital anomalies" precedes the main heading in aphabetical order. Dr. Ledley states that this arrangement would enable a magnetic tape to be entered at a specific location, and to be searched downward until the tape came to the signal to rotate to the beginning of the alphabet. Dr. Ledley further suggests that this method is preferable to searching the entire contents of a magnetic-tape reel indiscriminately.

Another aid to eventual mechanization is the section's Dictionary of Terms, which may be used as a coding manual in the event of electronic data processing applications.

5. DICTIONARY OF TERMS

The section's revision of its Dictionary of Terms is a continuing function. The latest revision, dated August 1, 1960, represents a comparison of the terms compiled by this section with those contained in the subject heading authority list of the National Library of Medicine. The section plans to edit and amalgamate the terms, during the next year, for possible use as a coding manual.

6. MAINTENANCE COSTS

During the fiscal year 1960, the section operated at a level of 4 man-years for professional, and 9 man-years for clerical personnel. (The professional staff was not numerically adequate to handle the volume. Future plans include the addition of seven professional personnel and two clerical.)

No items of major expense for equipment were incurred during fiscal year 1960.

TABLE 3.—*Comparison of index-control systems for NIH extramural programs*

Source	Type of documents indexed	System of indexing	Areas covered	Method of retrieval	Purpose
NCI	Applications	Selected categories, primary and secondary classifications.	Cancer grants	McBee keysort	Primarily for budgetary analyses, program planning and evaluation, secondarily for informational purposes.
NHI	do	do	Heart grants	do	Do.
NIAID	do	do	Allergy and infectious diseases grants.	Typed 3 by 5 cards	Do.
NIAMD	do	do	Arthritis and metabolic diseases grants.	McBee keysort	Do.
NIDR	do	do	Dental grants	do	Do.
NIMH	Applications, progress reports, publications, summary sheets.	do	Mental health grants	IBM cards	Do.
NINDB	Applications, publications	do	Neurological disease and blindness grants.	McBee keysort	Do.
DGMS	Applications	do	General medicine grants	do	Do.
DRG-RIS	Abstracts of applications, progress reports, publications.	Modified coordinate-indexing—precoordination of terms.	All Institutes	Typed IBM cards preliminary to mechanization.	Primarily for dissemination of scientific research information, secondarily for program planning and evaluation.
Bio-Sciences	Abstracts of applications	Selected categories plus limited number of uniterm type entries.	do	IBM cards; Burroughs computer; documents filed under multiple headings.	Multipurpose.

7. COMPARISON OF RESEARCH INFORMATION SECTION'S ACTIVITIES WITH RESPECTIVE INSTITUTE SYSTEMS

The comparison of the Research Information Section's activities with those of the respective Institutes is shown in table 3. In summary, the Section activities differ from those of the individual Institutes in the following respects:

(*a*) *Type of documents indexed.*—The Section is responsible for indexing more documents per grant than the individual Institute; e.g., progress reports and publications, in addition to abstract of application.

(*b*) *System of indexing.*—The Section uses a modified coordinate indexing system, which permits depth of indexing, flexibility of headings, and inclusion of specifics, to a much greater extent than the various Institute systems. On the other hand, the Institute systems are designed to give coverage of general areas, which are unique to Institute programs.

The Institute programs classify projects according to primary categories—for fiscal allocations—and secondary categories, according to importance of the various aspects of the research project. The Section's system of coordinate indexing does not indicate primary and secondary allocations; all scientific aspects of a project are of equal weight in coordinate indexing.

(*c*) *Areas covered.*—The Institutes index only Institute extramural projects. The Section indexes projects for all Institutes, and for both intramural and extramural programs.

(*d*) *Method of retrieval.*—Most of the Institutes use the McBee keysort, manual system of retrieval for specified, predetermined categories of information. The Section uses an alphabetic, subject-heading card arrangement. At present, the Section is using headings, typed manually on IBM cards, but plans to convert the typed IBM cards to punched records as soon as possible.

(*e*) *Purpose.*—It is in this area that the Research Information Section differs most from the Institute systems. The Section's purpose is primarily for dissemination of scientific research information. The Institute programs are designed primarily for budgetary analyses, program planning, and program evaluation. The analyses are performed by personnel who have close contact with offices concerned with Institute appropriations and objectives.

The Section can answer questions which pertain to "Who is doing specific types of research, and how?" Answers to these types of questions often overlap Institute boundaries. The Institutes can more readily answer questions which relate to "What general areas are covered and how much money is being spent for the support of such programs?" Both types of information, of course, can be obtained from either the categorical or the coordinate indexing system, except that Institute systems will not answer so-called odd-ball questions. (The odd-ball questions are those which have not been anticipated and which, therefore, do not fit into preconceived, general categories.)

8. RELATIONSHIP WITH BIO-SCIENCES INFORMATION EXCHANGE INDEX SYSTEM

The Bio-Sciences Information Exchange compares more nearly with the separate Institute systems than it does with the Research Information Section. It covers only the abstract of application—most Institutes use the application as the basic document. BSIE uses general categories, and determines primary and secondary categories for fiscal compilations, as do the Institutes.

BSIE, during the past few years, has added many uniterm-type entries into its categorization scheme. These, I would surmise, are necessary indexing aids to give flexibility to an otherwise rigid, categorical scheme. These uniterm-type additions enable the BSIE system to simulate more closely the Research Information Section's system of coordinate indexing. Even so, the unique advantage of BSIE still lies in the fact that it is a ready source for answering questions which relate to categories; while the Research Information Section's system of modified, coordinate indexing is more accessible for detailed, specific items or groups of items.

Division of Research Grants, NIH

RESEARCH INFORMATION PROCESSING BY THE NEWLY ESTABLISHED STATISTICS AND ANALYSIS BRANCH, DRG

The present system of information storage by this Branch is built around punched cards and IBM equipment. The statistical information so coded embraces fiscal matters and processing actions, identified through grant number to name of principal investigator, title of research project, and name and geographic location of grantee institution. Subject matter of the research is indicated solely by (*a*) the title of the research project, and (*b*) the supporting National Institutes of Health. We realize clearly that these two items are no more than suggestive of subject matter; it is not their function on the card to serve that purpose.

This system is in the process of being redesigned (i) to permit of much greater coverage of information, and (ii) to facilitate rapid recovery of information in summary form. We are not yet in a position, however, to include an effective classification of research projects by subject matter. This is primarily because creation of such a classification depends on research of tremendous scope. Although we have been active in this area for over a year, the coverage of it is so great that our attack constitutes little more than exploratory probings so far.

Commencing with current fiscal year actions we have already included in the new system a breakdown of grantee institutions into their major components (medical school, institute of technology, etc.) and Departments (or divisions, sections, etc.) of affiliation of the principal investigator. These have some value, little though it be in many cases, in identifying research areas. We have also built a preliminary "specialty" code to include information on the professional group in which the principal investigator places himself. While this again does not describe his field of research, it does indicate his primary affiliation among fellow scientists. Other biographical data to be coded into the system will serve in an ancillary role to professional specialty and hence to defining research interest.

Beyond these items of information, which we now request of applicants (hopefully without endangering the fostering of medical research), there will be as widely expanded a program of special studies as our resources permit. These studies will frequently require the assembly of new information, either by complete survey or carefully stratified probability sample.

It is hoped that we can eventually devise a manageable mechanically operated system of biographical information to embrace all NIH consultants, principal investigators and their professional aids in supported research, and beneficiaries of the many fellowship and training programs. This is a project of such proportions that we cannot undertake it this year.

Division of General Medical Sciences

INDEX CONTROL SYSTEM

At the inception of the DGMS Research Grant Branch program a detailed review of recordkeeping methods of other Institutes was conducted for immediate needs. The McBee keysort system of program analysis was developed and includes all RG grants paid during the 1959 fiscal year and all applications received in the Branch thereafter. Each application pending Council action is classified by program analysts into primary and secondary scientific areas of relevance. The analysts code the scientific material from the application to a worksheet. This material is transferred to the grant record card and punched accordingly. Fiscal information is also coded and recorded, i.e., years of commitment, current period dates, Study Section and Council action, and payments of award.

The system provides a readily accessible means of obtaining information and serves as a quick reference as to status of a grant at a given time, especially in current and pending information. The system has been used extensively in developing budget and programing reports requested by NIH. These reports are presented by the staff upon its own initiative or upon request to the National Advisory Health Council, the Study Group in the reorganization of the Public Health Service, or to Congressional groups or individuals. The system has also been used continuously by the Branch.

The Bio-Sciences Information Exchange provides the DGMS Research Grants Branch, prior to each meeting of the NAHC, a complete listing of all current and anticipated grant support by other agencies on each application to be reviewed. These lists are reviewed in connection with our programing efforts and have always provided an accurate report.

The BSIE has provided the Branch summaries and reports of research sponsored by all NIH Institutes, by field, by type of investigator, and by geographical distribution. The exchange has readily supplied information by telephone and by written reports, and has proved a valuable source.

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